Editorial

AS the impact of television upon overseas viewers becomes clearer, more and more people are showing serious concern about its possible effect on our opinions and thinking habits.

Almost every day, intelligent men and women at home and abroad express their grave misgivings that television will outshine all other modern devices in its ability to kill individual development of thought and action.

Its predecessors in the field of entertainment have already discovered the alarming inclination of so many people to accept ideas rather than to think for themselves. The inclination to watch others in action, rather than to act.

But television has them all licked to a frazzle as a "propaganda" machine. The temptation to carry laziness to the ultimate extreme by simply sitting, looking and listening, is apparently proving irresistible to large numbers.

It is quite true that the same material has been available for centuries through literature and the stage: That the talking picture makes it available en masse every day of the week. That broadcasting brings a proportion into your home. This is true enough but television rolls it all up into one and puts it right in the living room. It isn't a matter of novelty so much as accessibility.

Undoubtedly, the fascination of television is greatest for young people, to whom the development of mental independance and initiative is vital.

Can anyone doubt that the loss of this mental initiative, the tendency to do as the other fellow does, is at the root of our biggest social problems today? Were we really better off when we made our own recreation and won strength through solving problems the hard way? Is knowledge more important than wisdom?

It is foolish to condemn such ideas as old-fashioned or obstructive. It is certainly unwise to ignore them.

I say again that these very things, rather than matters technical, will pose television's most vital problems. They must be freely discussed and examined without bias or prejudice. If our fears are groundless, let us hasten to prove them so. If they are not, we must be prepared to do something about it.

Television will come, whether we like it or not. The important people, however, won't be those who produce the programmes or the signals—they will be the men who grant rights and say how television shall be used. These people hold the real power to build or destroy. The potential for bad in television is balanced only by its potential for good.

John Moyle

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RADIO AND HOBBIES IN AUSTRALIA

A NATIONAL MAGAZINE OF RADIO, HOBBIES AND POPULAR SCIENCE

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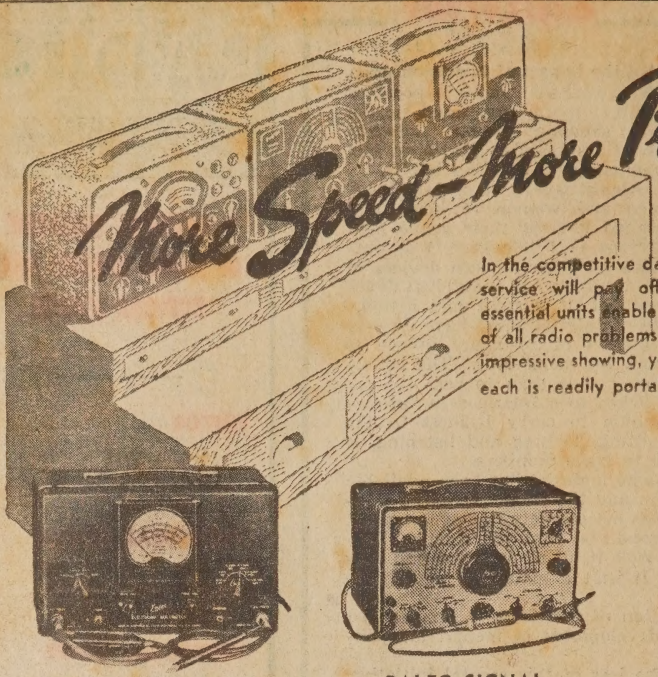
OUR COVER PICTURE

Quite frankly, we don't know what inspired the choice of this picture for our cover. Perhaps it reminds us of the activities of the technical staff and/or the Editor.



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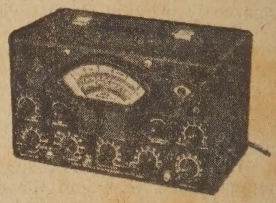
In the competitive days ahead, better and quicker service will pay off—handsomely. These three essential units enable quick and effective diagnosis of all radio problems . . . combined they make an impressive showing, yet, individually self-contained, each is readily portable for outside service.



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Dimensions of case: 14 ins. x 8½ ins. x 8½ ins. Weight: 29lbs. Available for 220-260 volt A.C. and external vibrator operation.
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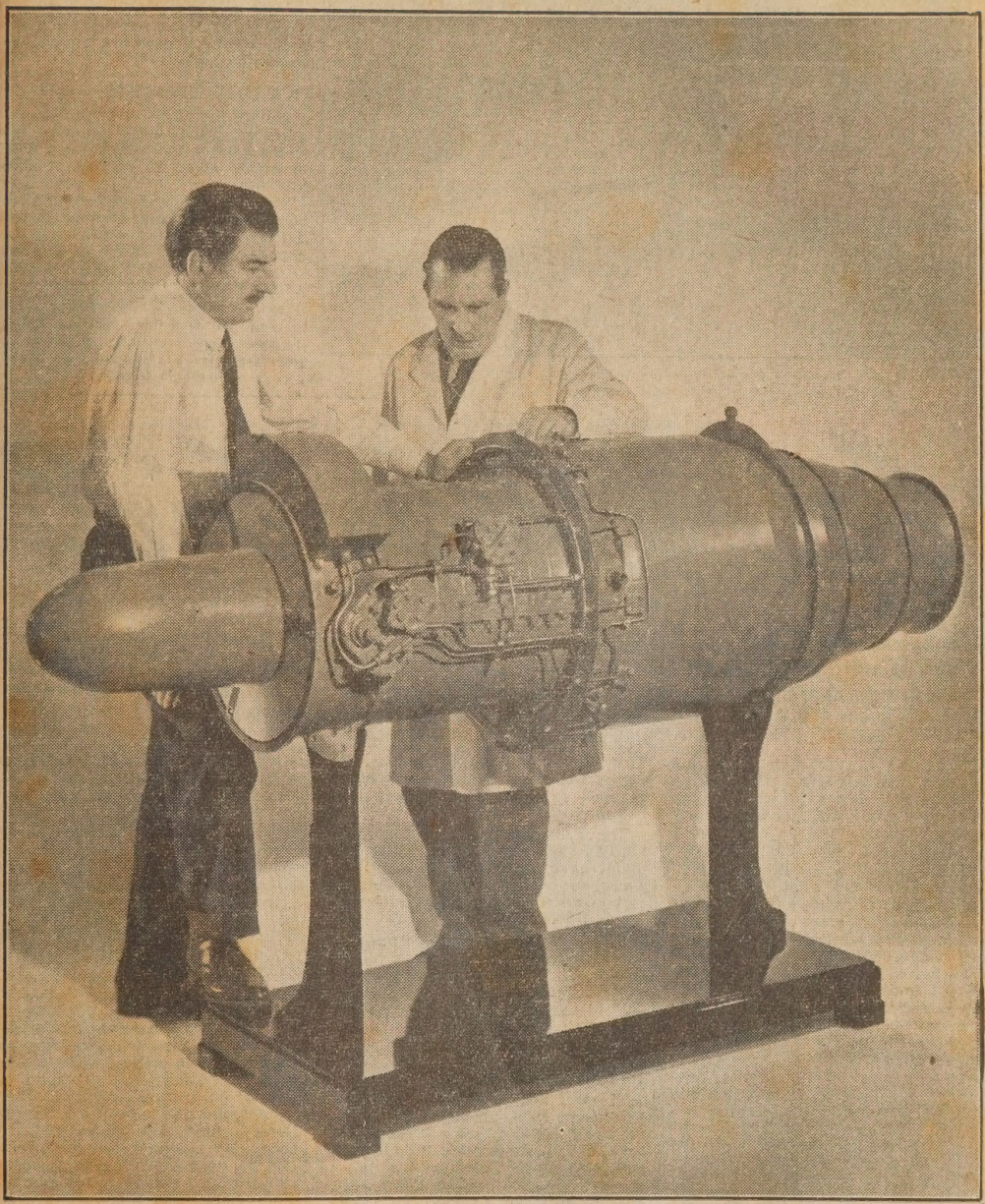
JET FOR PILOTLESS AIRCRAFT



ACCORDING to a recent announcement, Australia is experimenting with pilotless fighter aircraft. It is now revealed that the power plant is an Armstrong Siddeley "Viper" jet. Produced by the same team which gave Britain the "Sapphire"—the world's most powerful jet engine—the New "Viper" is especially intended for use in expendable aircraft, and uses low cost components. It has an annular combustion chamber and an axial flow compressor. With an overall diameter of only 20" and a weight of about 400 pounds, the "Viper" has a thrust of 1500 pounds. The picture shows a mock-up of the new engine.

It can be pretty "nippy" getting off to work on a winter's morning but it's never really cold. A full 500 degrees separates a cold day from the ultimate in frigidity.

Going Down Sir?

Imagine a liquid that won't stay put in a test tube. Matter that is neither solid, liquid nor gas. Electrical circuits with so little resistance that self-oscillation keeps on going. Electrons which slow almost to a dead stop. Fluids which flow through air-tight seals. These are everyday phenomena to workers at sub-zero temperatures.

THE man in the street looks on dry ice as about the coldest thing ever. It's a lot colder than ordinary cold and it freezes ice cream so hard that you can't cut it with a spoon. But snow and frost and ice—and even dry ice—are "hot" to the modern scientist.

Persistent research has now made it possible to achieve a temperature so low that it affects even the nature of matter. A whole new world is revealed of strange oddities and apparent contradictions. But the scientist is not interested in mere novelties, but in the promise they hold of processes which might otherwise be quite impossible.

Back in the 1700's Gabriel Fahrenheit went to work with ice and salt to produce what he then believed must be the ultimate in coldness. Based on this, he gave the world the scale of temperature which still bears his name.

A NEW LOW

It later became apparent that Fahrenheit was a long way too far up the tree. It was found that, if gases were compressed, subsequently cooled and then finally released through a nozzle, the temperature would drop to unheard-of depths. This very method was used by Sir James Dewar in 1898 and by Onnes in 1908 to liquefy hydrogen and helium respectively.

The Fahrenheit scale left a margin of 30 odd degrees for things that might have been colder than frozen water, but ordinary dry ice—solidified carbon dioxide—gets down to below minus 100 degrees F.

By the time nitrogen liquefies, the temperature has dropped to about minus 320, but a further drop of 100 degrees is necessary before hydrogen and finally helium, approaches the same state. By that time, it's getting really cold.

THE "ABSOLUTE" SCALE

Tired of all the minus signs, Lord Kelvin, in 1898, produced the "Kelvin" or "absolute" scale of temperature. This assumed that the ultimate rock-bottom in frigidity would occur at minus 460 degrees Fahrenheit, and, at this temperature, all molecular action would cease. There could be nothing colder, he reasoned, because matter would have given up all its energy and there would be nothing left to force the temperature lower.

Kelvin was not far out in his deductions, and research workers are unearthing a wealth of valuable information as they probe the regions close to absolute zero.

To date, the extreme temperatures have been produced mainly by the expansion technique, operated on a large scale, and with many refinements. A large compresseor, for example, may draw hydrogen from a huge storage tank and force it under some 2000lb of pressure through refrigerated coils.

COOLING CHAMBER

It may then pass through a cooling chamber filled with liquefied gas, which carries the temperature down to within about 70 degrees of absolute zero.

Thus cooled and already on the verge of liquefying, the compressed hydrogen gas squirts out through tiny expansion valves. Much of it immediately becomes a vapor, which drips down into the bottom of the expansion chamber. The rest goes back into the main hydrogen circuit, and pre-cools the supply entering the compressor.

The same technique is used for helium, but with necessary changes in temperature and pressure. This time the liquid hydrogen helps to refrigerate its colder brother on the way down to its boiling point of 4.2 degrees absolute.

STORAGE

The liquids are kept in glorified versions of the domestic vacuum flask, but with extra walls and an initial insulating layer of liquid air at about 80 degrees absolute. Then, by reducing the pressure in the "Dewar" flask, the boiling point of helium, for example, can be lowered from the normal 4.2 degrees to something nearer 1 degree above absolute zero. Tricks like this help prevent the precious liquids from boiling themslves back into gases.

By bringing magnetic processes into play on top of this, it has been found possible to achieve a temperature within .0015 of a degree above absolute zero.

Actually, magnetic effects are uti-

lised to measure these extreme temperatures since, obviously, conventional thermometers cannot be used below the point where the measuring liquids would solidify. Mercury freezes solid about minus 39 degrees F and alcohol passes out soon after.

"Super-cooled helium, hovering within a couple of degrees from absolute zero, must be one of the world's strangest substances. Viewed through a tiny observation window in its own flask, it shimmers like silvered glass. Turn the window toward a source of light and the liquid immediately extracts heat from the beam and begins to boil away.

It can penetrate the molecular structure of materials and seals that would normally be regarded as completely airtight.

DEFIES GRAVITY

Plunge an empty tube into the container and the helium will run up and over the rim to balance the liquid level inside the tube and outside. Lift the tube up again and the liquid will run up and over into the main container.

The liquid transmits heat waves in much the same way that other substances transmit light and sound vibrations. The heat just doesn't work its way through. In fact, it's hard to classify this "Helium II" as liquid, gas or solid in the normal sense of the terms.

The peculiarities aren't by any means confined to liquid helium. Most substances which are still liquid at near absolute zero tend to lose their frictional resistance. Set them swirling in a container and they keep on swirling until ultimately they evaporate.

One substance apparently defies gravity by crawling straight up the sides of its container at a rate of eight inches per second.

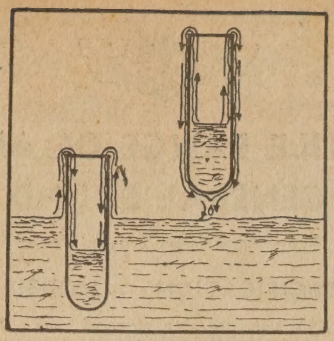
Ordinary substances change their character immediately in the presence of extreme cold. Liquids lose their frictional resistance. Rubber becomes hard and brittle. Fruit can be broken with a hammer. Even metals become so brittle that some will crumble under slight stress.

PROVEN RESULTS

Looking back over past results, scientists can point to tougher glass, to rubber which wears longer under widely varying temperatures, stronger metals, improved petrol and even more effective fertilisers.

Research workers are studying these effects, not for their oddity, but for the information they can give about the behavior of materials in less-cold, long-term service.

Strange things happen to electrical and magnetic properties. Electrical resistance falls to almost nothing. Conductors become "super-conductors." A bar magnet dropped toward a super-conducting sheet induces eddy currents of such magnitude that the magnet bounces away and "hovers" over the surface. The sheet becomes an almost perfect shield for the magnetic lines from the magnet.



Supercooled helium will flow up and over the edge of an empty test tube (left) or out of a full one (right).

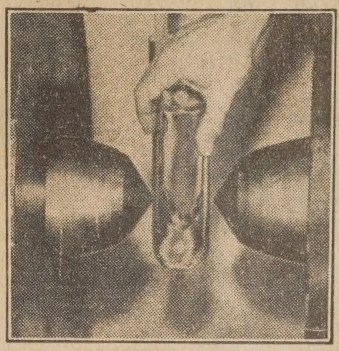
Radio detectors, too, begin to exhibit super-sensitive qualities and miniature "frigised" radios are visualised which will be sensitve to fantastically weak radiations.

Not content with small-scale research, the G.E. Co., of America has now produced a machine which liquefies helium by the simple process of making it do work. As it passes through the machine the gas actuates a series of small piston engines, giving up temperature as it gives up energy. In this fantastic "refrigerator" you can treat and study quite large objects.

The machine, developed by Dr. S. C. Collins, stands some 12 feet high and looks rather like the conning tower of a submarine. The operator stands on a raised decking and can view the operation through a large porthole.

The helium is drawn in and runs from one tiny "engine" to the next, expending its heat energy as it passes from one to the other in a perpetual cycle. Finally it drops as a liquid to the bottom of the tank, where it can be drawn off.

The larger Collins machine has four cylinders but smaller two-cylinder versions are already available for use in the world's "cold" research laboratories. Entirely new experiments can be conducted in their capacious interior.



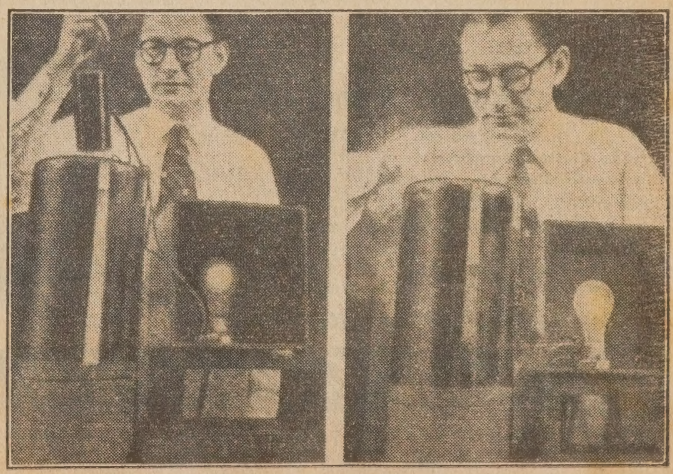
Hold a test tube of liquid oxygen between the poles of a powerful magnet and the liquid forms a U-shaped gully.

REALLY COLD

A lump of metal can be made so cold that it will liquefy the air round it as it is brought outside. Freeze a metal pan, then bring it outside and it will immediately begin to fill with liquid air.

And, of course, there's nothing like a minus 300-degree blast of gas to shrink a bearing, if you must fit it into a tight hole.

Continued research in this region of super-cold may easily show the way to the ultimate inter-planetary travel, using rockets or space ships capable of enormous speeds. At the Ohio State University the highest exhaust velocity ever achieved was obtained from a miniature rocket engine using liquid hydrogen as the fuel and liquid oxygen as the oxidiser. A gas velocity of 15,000 mph was measured at the tail of the jet.



The globe on the left is dimmed by the resistance of a copper coil which carries the current to it. Dropping the coil into liquid nitrogen reduces its resistance and allows the globe to glow brightly.

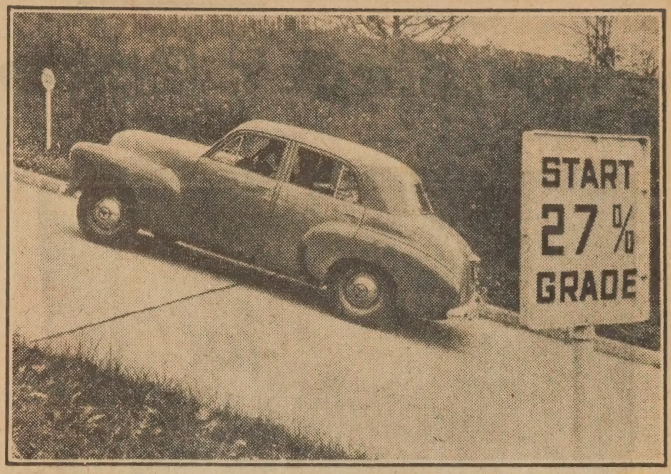
HOW MANY HORSES PULL YOUR CAR?

POWER ratings for engines as applied to motor cars are not particularly exact because there are so many contributing factors to be considered. Manufacturers' figures can be taken as a rough guide, but only with a background of how these figures are determined.

Actually, power and horsepower are exact physical quantities defined as the rate of doing work. For instance, a man can move a ton of sawdust from A to B in a shorter time than a boy. A horse will take still less time. In all three cases, the amount of work done is the same, but the man is more powerful than the boy and the horse more powerful than the man.

About 170 years ago, James Watt conducted some experiments to determine the amount of power the average horse could exert continuously. Allowing a certain percentage for friction, he found that a strong horse could exert 33,000 foot-pounds per minute, and this is still the standard by which most engines and motors are rated.

Watt allowed for much more friction in his test mechanism than was actually present, and the average strong horse could not possibly exert his 33,000 foot-pounds per minute. However, this is not of great importance, as the horsepower is still useful as a practical unit.



An Australian "Holden" undergoes a road test at the General Motors' proving ground. This is where the real horsepower tells.

So you've just bought a new car! Perhaps you have been telling everyone how powerful it is and how efficiently it performs. But don't take the manufacturer's figures for power output too literally. There is more to it than meets the eye as you will realise when you read through this article.

Motor car horsepower ratings are probably the least understood. Most car engines are given at least two ratings. The lower rating is worked out from a formula which was arrived at many years ago and does not represent the real horsepower of modern engines. However, it forms a rough basis for comparison and is still used for licensing purposes.

The higher figure, which manufacturers usually advertise, is the real power output of the engine, but it is determined with the fan, generator, oil, water and fuel pumps removed. The actual power delivered to the clutch of a complete car is considerably less.

TAKE YOUR PICK

In determining the performance of an engine, the designer may have to consider as many as five different varieties of horsepower.

In the case of a typical medium-sized postwar car, the total amount of power developed in the cylinders, including the power needed to drive the engine itself, may be 96 horsepower.

Friction inside the engine occurs between piston and cylinder at crankshaft bearings, camshaft, &c., and in the case of the same car may account for 16 horsepower. Therefore, the figure advertised by the manufacturer would be 80 horsepower.

However, the various essential accessories may require 9 horsepower, so that only 71 horsepower is delivered at the clutch.

Unfortunately, since the transmission and wheel friction waste power, even the 71 horsepower is not available to drive the car and you could expect to measure about 55 hp at the rear wheels. This means that in the case of an engine with a potential 96 hp, 41 hp is wasted.

In spite of all this, the car is rated at 20 horsepower, since this is the figure worked out from the formula.

OTHER ENGINES

Stationary engines are usually rated in terms of the power that can be delivered continuously at the crankshaft without overheating. The same rating applies to electric motors if the machine being driven starts easily and runs smoothly.

At first glance it appears paradoxical, but very frequently a petrol engine rated at, say, 3 hp, will only perform the work of a 1 hp electric motor.

This is due to a fundamental difference between petrol engines and electric motors. The petrol engine is a self-contained power unit, but the electric motor is merely a device for converting electrical energy to mechanical energy.

If the electric motor is overloaded it simply draws more current from the power mains and for a short period may actually develop the 3 hp. If a 1 hp petrol engine were substituted for the 1 hp electric motor in the same case, it would simply stop when overloaded. Of course, the electric motor is only capable of withstanding the overload for a short period of time. If it were applied continuously the motor would overheat.

HP AND WATTS

Horsepower can be converted directly into watts or kilowatts, since both are units of power. While horsepower belongs essentially to the British system, the watt is really a metric unit, but since both are used in this country it is handy to remember that one horsepower equals 746 watts or .746 kilowatt.

It is interesting to note the amount of power consumed by ordinary everyday devices. For instance, 1 horsepower, or 746 watts, will operate twelve 60 watt lamps, but this same amount of power would only be sufficient to boil a kettle of water on the hotplate of your electric stove.

A strong man working continuously is the equivalent of about 1/10th horsepower, while a trained athlete can develop about 1 horsepower, but only for a very short period.

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MODEL 508

makes available to Radio Dealers and Home Constructors a full range of Console Radiograms and Combinette Cabinets.

Made from best quality Maple and Italian Walnut-veneers finished with a brilliant piano finish.

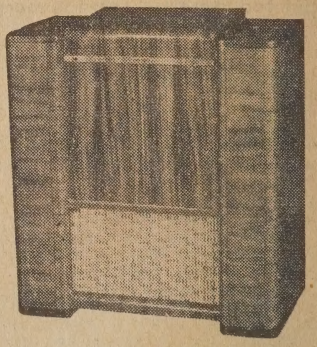
Model 508 is suitable for all types of Record Changers.

Model 509 is suitable for Single Motors. Dial fits on front of Cabinet, Lid being lifted only for record playing.

Model 509A is suitable for Record Changers.

Model 510 is a Combinette type Cabinet large enough to take a 5 Valve D/W Set with a Single Motor.

EXPERT PACKING FOR OUT OF TOWN DELIVERIES



Model 509

THE ABOVE CABINETS ARE ON DISPLAY AT UNITED RADIO, PHILLIP ST., SYDNEY

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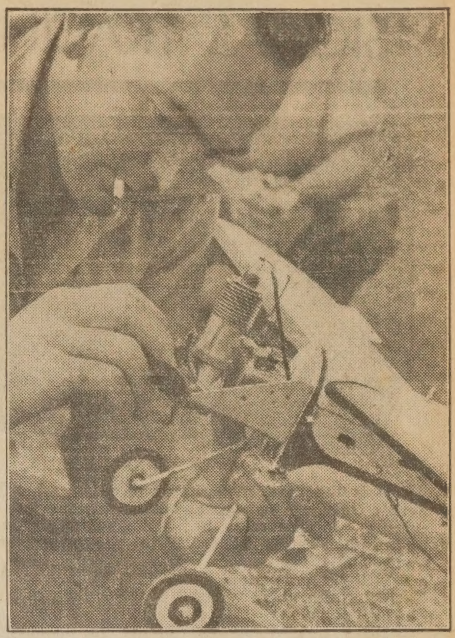
SCIENCE CREATES NEW HOBBIES

Great technical developments in industry, many of them due directly to the war, are going to mean that, in the future, if we arrange our affairs well, every man and woman can enjoy far more leisure than in the past.



A man and his model! Mr. L. Stevens was snapped as he adjusted his baby plane ready for a flight in Sydney's Centennial Park.

by Professor A. M. Low

AUTOMATIC machines and controlling devices will do more and more of the "donkey work" and when the period of making good the damage of war is over, they should enable us to have a comparatively short working week.

For the ordinary man and woman this implies much more time for hobbies and sports. We may expect to see new pastimes being developed in response to the demand.

One man's work is another man's play, and this fact may well be the basis of the development of new hobbies. I have often defined "work" as something you do in your employer's time and "play" as something you do in your own time. I think many of the new hobbies will be "work" done for pleasure.

DEVELOPMENT OF SKILL

Much of the joy of a hobby comes from the exercise of skill, which takes time and study to develop. The amateur gets real pleasure out of something which, if he had to do it for his living, would lose much of its attraction.

Many of the new hobbies will be based on the exercise of technical skill in the sciences. Let me give an example. The making of fine lenses for telescopes is a highly skilled business, requiring theoretical knowledge and a certain ability in the manipulation of instruments, as well as great patience.

Of course, the easiest way to get a telescope is to go to a shop and buy one with lenses made by craftsmen who spend their life at it. But the amateur astronomer gets far greater pleasure out of grinding his own lenses. Many have mastered this art.

NATIONAL ASSET

In America, where, perhaps, highly technical hobbies are more widespread, for reasons not hard to understand, there are some hundreds of amateur telescope makers. Incidentally, their skill was shown during wartime, when, in response to an appeal, they made very fine lenses for a particular purpose, in their spare time, for the use of the US forces.

One of the essentials of a good hobby is that it should not have limitations. You do not want something that is fairly easily mastered completely and then offers no further interest. The advantage of scientific hobbies is that there is no finality about them.

You may begin experiments in chemistry with a score of cheap chemicals and a few test-tubes. You can proceed to the most intricate piece of research; the answering of some question, perhaps, that you have posed for yourself.

Believe me, there are plenty of unanswered questions in chemistry and it may well be that they will be answered in the future by amateurs (as in the past) working in their home laboratories.

The amateur is disinterested. He can afford PURE research and his interpretation of whether an experiment PAYS is whether it gives him pleasure and not whether it gives financial return. It is interesting to remember as an example that all Perkins' great discoveries of synthetic dyes were based on his experiments as an amateur in trying to make synthetic quinine.

In the future, there, I expect scientific hobbies to gain thousands of adherents, for thousands of homes to have their workshops well equipped with lathes, tools and chemicals, according to the special line being pursued.

The new possibilities in mass production should enable the ordinary man to possess mechanical equipment which only a few years ago would have been restricted to the wealthy amateur or the factory. I shall expect to see increasing numbers of amateurs making or adapting motor cars, motor wheelbarrows and other novel forms of transport; perhaps new mechanical tools for the garden or small holdings, and working models of all kinds.

INVENTION

The amateur, of course, will not primarily be concerned in profit or fame, but a proportion of useful inventions should result. We must not neglect our amateur inventor. I should like us to become a nation of amateur inventors, because that means a high standard of technical skill.

In America they have "clubs" where people, and especially boys in their teens, with any inclinations towards scientific hobbies get all the facilities they need in their evenings and holidays. Incidentally, American industry has benefited by many pieces of research and inventions made by these amateurs.

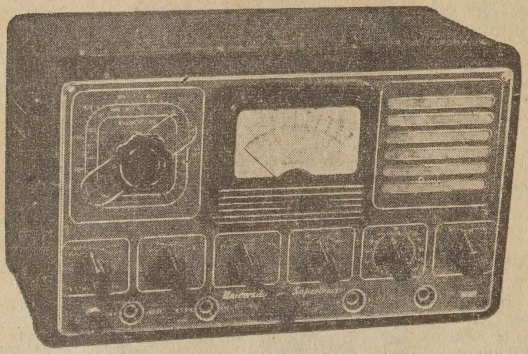
What about new games? The competitive instinct is the basis of artistic and scientific hobbies. More leisure will probably mean more games.

Those who have thought on this subject will have noticed the tendency for games to become more scientific. The new sports which

(Continued on Page 95)

University news:

SIGNAL TRACING & SET ANALYSIS



With the most up-to-date and Versatile Instrument

THE

SUPERTRACER MODEL AST

This is the most modern, up-to-date, and efficient service instrument that anyone could desire. It is easy to use and gives rapid and accurate location of faults in radio receivers and similar equipment. It speeds up testing, servicing, and production, and will rapidly detect faults which render a receiver inoperative, or which make it intermittent or lacking in sensitivity, or which cause oscillation, distortion, or hum.

The instrument comprises a two-stage tuned R.F. amplifier, a diode detector, and two-stage A.F. amplifier, and, of course, a loudspeaker and power supply. In addition, a vacuum tube voltmeter measuring up to 500 volts A.C. or D.C. at a resistance of 11 megohms on D.C. and 10 megohms on A.C. is provided. The tuning range of the R.F. circuits is 175 to 490 K.C., 550 to 1550 K.C., 1.5 to 4 megacycles, and 6.3 to 18 megacycles. R.F. sensitivity is such that input voltage of the order of a few millivolts may be detected on all ranges, so that the instrument is suitable for use in any district where alternating power mains are available. A capacity type R.F. multiplier in the input circuits in conjunction with the V.T.V.M. enables stage gain measurements to be made.

TEST PROBES: The R.F. test probe is fitted internally with a very small series capacity of a few micro-microfarads, so that it does not produce an appreciative detuning effect when applied to the grid or plate of R.F. or I.F. stages in a receiver. The A.F. test probe is a conventional shielded lead for feeding A.F. into the tracer or A.F. out from the tracer for testing A.F. amplifiers or speakers. The D.C. probe contains a series 1 meg isolating resistor, so that the V.T.V.M. may be used to measure plate bias or A.V.C. voltage under actual operating conditions without disturbing the action of a receiver.

VACUUM TUBE VOLTMETER: The V.T.V.M. features a centre zero scale for direct voltage measurement, so that voltages which are either positive or negative with respect to a receiver's chassis are instantly indicated without the necessity of reversing test leads or operating a reversing switch. Zero is at the left for alternating voltage ranges, and operation covers the audio frequency range. Voltage ranges are 0/5, 0/25, 0/100, and 0/500 volts at an input resistance of 11 megohms on D.C. and 10 megohms on A.C. ranges. In conjunction with the amplifying stages of the tracer, the meter will indicate R.F. or A.F. voltages down to a value of less than 1 millivolt. Indications are provided by a large, clearly marked rectangular meter with illuminated scale fitted in an attractive modern plastic case measuring 4¾" x 4". The V.T.V.M. and tracer may be used simultaneously for observing signals at two distinct points in a receiver. This feature greatly facilitates location of intermittent faults. Operates from A.C. 220 to 260 volts.

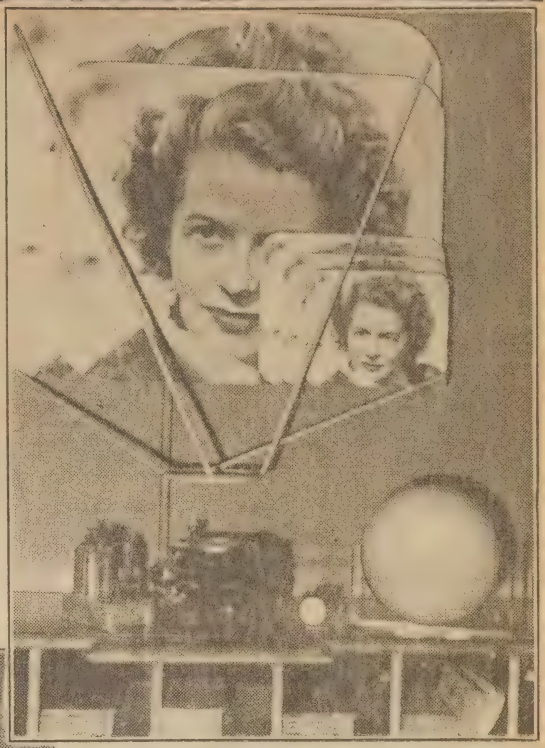
RADIO & ELECTRONIC TEST EQUIPMENT

University

Made by University Graham Instrument Co., 5 North York St., Sydney. 'Phone BO3169 (2 lines).

LARGE SCREEN TV. IN THE HOME

While the US is absorbed with the problems of color television, the emphasis in Britain for the 1951 season might easily be on large screen black-and-white television for the home. These pictures illustrate the progress that is being made.



UP to the present, nearly all home television receivers in England and the US have employed large cathode-ray tubes with the screens viewed directly or through a simple 45-degree mirror.

While this allows for unit construction, it is frequently contended that even the largest practical tubes do not give a really satisfactory picture and that television, in the long run, must be able to project large pictures which will stand comparison with home movie equipment.

BETTER FOR AUDIENCE

Such pictures could be viewed by larger audiences and viewers would have far greater freedom of movement than is possible with the present small images.

The big problem is to produce small picture tubes having sufficient resolution and screen brilliance to allow for projection. At the same time they must be convenient to operate, economical to replace and have a reasonable service life.

The Schmidt system, using moulded plastic components appears to offer the best answer to the requirement for an inexpensive, mass-produced optical system.

At a private Exhibition, organised recently by the Radio and Electronic Component Manufacturers' Association, one manufacturer exhibited a complete projection adaptor which is scheduled for general release during 1951. This is shown above.

It takes the place of the normal 12-inch tube, the adaptor involving an auxiliary unit, a compact optical system and a 2½-inch projection type picture tube. The unit projects normally on to a screen placed behind and above a console receiver. As depicted by the display, the picture size can be varied over wide limits according to the projection distance and the adjustment of the optical system.

PHILIPS' UNIT

Philips have also demonstrated recently a rather similar arrangement, illustrated at left, which can be used in conjunction with an orthodox receiver. It also uses a 2½-inch tube and a compact optical system, using a spherical mirror and a correcting plate. The tube is held in position by a cradle which allows the tube face to be aligned with the optical system to a high degree of accuracy.

The picture size varies from 12" x 16" for a short throw up to 3ft x 4ft with a throw of 9 feet.

New Treatment for Roads

BRITISH scientists, by a new treatment for crushed stone, have ended the ruin a heavy rainfall can cause to a freshly-tarred road. A coat of creosote, mixed with a chemical wetting agent and applied to the stone, has been found to keep out the water. From tests carried out on roads in many parts of England, the result is that the stone sticks to the road no matter how hard or how soon it rains after the dressing has been applied.

These "outboard" spectacle lenses are horizontally polarized. When squeezed together so that one glass is rotated 90 degrees with respect to the other, no light can get through the overlapping portion.

ABOUT POLARISED LIGHT

That two panes of glass when placed one over the other can block the passage of light sounds like black magic. The secret is in their light polarization, explained in this article.

by Calvin Walters

THE phenomenon of light polarisation is assuming greater importance as industry marches on and science seeks better methods of safety and control.

Most people are familiar with the sun glasses which have acquired considerable popularity under the name of Polaroid. These consist of a sheet of specially prepared plastic and have the property of cutting glare from the sun or other bright illumination.

LIGHT PROPERTIES

To understand the action of this polarising material it is essential to delve a little into the physical properties of light.

According to what is called the vibratory or undulatory theory, light consists of a series of vibrations which are transverse or across the direction of propagation.

These vibrations take place in all directions at right angles to the direction of the light ray.

An experiment can easily be carried out with a piece of rope in order to illustrate the subject.

One end of a piece of rope is attached to a peg screwed in the wall. As we will also require a section of a picket fence or a slotted board it is as well if the peg is hammered into the fence instead of the dining-room wall, thereby maintaining domestic accord.

If the free end of the rope is now taken and the rope held loosely we will be in a position to illustrate our subject.

Shake the rope in all directions. The resulting pattern will illustrate how the waves travel in a ray of light. A series of waves will pass along the rope with complete irregularity, no one wave, either up or down, right or left, having any predominance. The waves, it will be noticed, are at right angles to the line of their forward movement.

This represents the waves in a ray of ordinary light.

Now, suppose you move the hand in an up and down movement. A simple wave form, having an up and down movement, will pass along the rope. This is analagous to a ray of PLANE POLARISED LIGHT in which all vibrations but those in one direction are eliminated.

If the hand is moved with a right to left motion a wave with a side to side motion will travel along the rope. This also represents a ray of plane polarised light with all vibrations but those of a sideways motion eliminated.

EARLY RESEARCH

This is exactly what occurs in those sheets of plastic mentioned earlier. They eliminate all rays but those in one direction.

This property of certain minerals of polarising light was discovered a long time ago, in 1818, by a French physicist named Malus, although he had no idea of the reason for it all. He merely knew that if one looked in the direction of the sun through a piece of calcite the glare from the sun was considerably diminished or extinguished altogether.

In 1852 a Dr. Herapath found that crystals of iodo sulphate of quinine possessed light polarising properties. But it was not until about 1933 that an artificial substance was found which could be manufactured in quantity. More about this later, however. In the meantime, let us get back to our piece of rope.

You now get from somewhere a section of a picket fence or two upright boards spaced about four inches apart. Pass the rope through the slot and waggle it about in all directions.

WAVE SELECTION

It will be found that only the up and down waves pass through the slot, all the others beings eliminated.

Now lay the fence or board on its side, with the slot parallel to the

ground. Waggle the rope as before. Only the side to side waves get through, the up and down waves being damped out.

Now take a second slotted board. Stand one with the slot vertical and the other with the slot horizontal, about four feet behind the first. Pass the rope through each slot. If the rope is now given an up and down motion a vertical wave will pass through the vertical slot and pass to the horizontal slot, where it is entirely damped out and the rope from there to the wall will remain still.

These experiments illustrate what happens to a ray of light when it passes through a polarising substance such as a piece of the mineral called Iceland Spar or a sheet of the special plastic.

RAYS SEPARATED

The ray of light consisting of vibrations in all directions hits the surface of the substance. All rays parallel to the axis of the crystal of Iceland spar or the crystals in the plastic sheet will pass through, while those at right angles to this axis will be stopped. (Slot in board in vertical position.)

If the crystal or sheet is turned sideways only the horizontal rays will pass through (slot in board horizontal). If two crystals or sheets are arranged with one vertical and the other horizontally over it no vibrations will pass through (one slotted board vertical and the other horizontal).

Dr. Herapath, mentioned earlier, realised the value of this polarising effect in the making of a filter for a microscope to cut out unwanted rays from his illuminating lamp. He tried for a long time to grow a crystal of iodo quinine large enough for the purpose, but did not succeed.

For more than seventy years the problem remained unsolved until a young fellow in America named Edwin H. Land hit upon an idea.

Whereas his predecessors in the field were all trying to make one large crystal, Land thought up the scheme of making thousands of very small ones and laying them on a sheet with their axes all laying in the one direction. All that was then necessary was to seal them up so that they would not shift.

This was all very well as far as it went, but how could one make thousands of microscopic crystals all lie in the one direction.

MANUFACTURE

It was observed by Mr. Land that if a pencil was laid at an angle on a rubber sheet and the sheet was then stretched the pencil turned and aligned itself in the direction of the stretch.

Why not take a solution of iodo quinine crystals, paint it on a sheet of plastic and then stretch the sheet. The crystals should align themselves in the direction of the stretch. The idea was soon put to the test and it worked.

Fixing the sheet so that it wouldn't return to its original shape was easy. So was the sealing of the crystals between another sheet of transparent plastic.

So, today, we have these plastic sheets moulded into a great variety of shapes of sun goggles to suit all noses and faces.

Like all new ideas, it took some time for the idea to "take on," but once having gained impetus all manner of ideas has grown from the original.

For instance, the idea of the two slotted boards, one vertical and the other horizontal, is now used in some American railway trains.

One sheet of plastic is fixed to the windows with the "slots" or crystals arranged in a vertical position. A second sheet is arranged over this, but which can be rotated by means of a knob.

When the two sheets are arranged with the "slots" parallel and vertical, all the reflected glare from the landscape is eliminated. The windows appear somewhat dark in color because this elimination of all but the vibration in one plane diminishes the light intensity.

But the window is quite transparent.

LIGHT SHADING

If, now, the knob is used to turn the movable window, the light is gradually diminished as the crystal "slots" cross each other, until at last when they are at right angles to each other all light vibrations are stopped and the window turns black. This position of the windowpanes is equivalent to the slotted boards when one is vertical and one is horizontal.

Thus, these windows need no shades and the amount of light entering the carriage is controlled merely by the turn of a knob on the movable window.

This light-regulating property of the two windows is used in the movie industry to provide smooth fadeouts. The filter is placed over the camera lens.

Reflected glare from roadways can be very troublesome to car-drivers. This glare is caused by the rays from the sun striking the road at an angle. The reflected light is partially polarised naturally, so that the major portion of the light entering the eye consists of horizontal vibrations which are very painful and confusing.

GLARE ELIMINATED

When vertically polarising lenses are used over the eyes, all these horizontal vibrations are cancelled out.

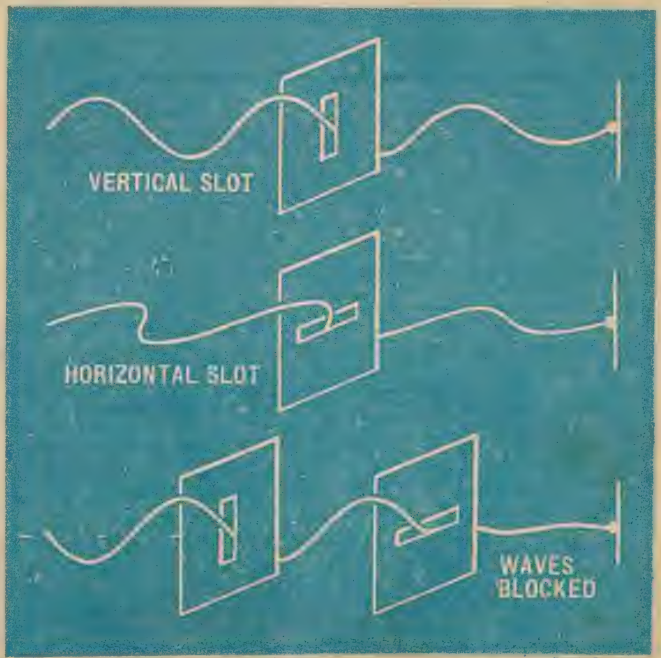
The same result is obtained when vertically polarising lenses are used to look into the water. Reflected glare is reduced or stopped and it is actually possible to look into the deep water when otherwise the glare would be too intense.

Suppose a pair of spectacles were made with one lens vertically polarising and the other lens horizontally polarising, what would happen to the eyesight of the wearer?

This has been done and some wonderful effects obtained with specially prepared pictures.

Specially prepared moving pictures were made during the war with a composite picture — one intended for use with the right eye and one for the left eye.

(Continued on Page 19)



This diagram shows how vertical and horizontal slots prevent "wiggles" in the rope passing through them.

Technical Review

AN AMPLIFIER ARGUMENT FROM THE U.S.

Transgressing a good deal of what is accepted as good high fidelity practice, an amplifier system credited to E. T. Flewelling has caused a stir in U.S. audio circles. The latest issue of Audio Engineering carries an article by the originator of the system and an editorial casting doubt on his arguments.

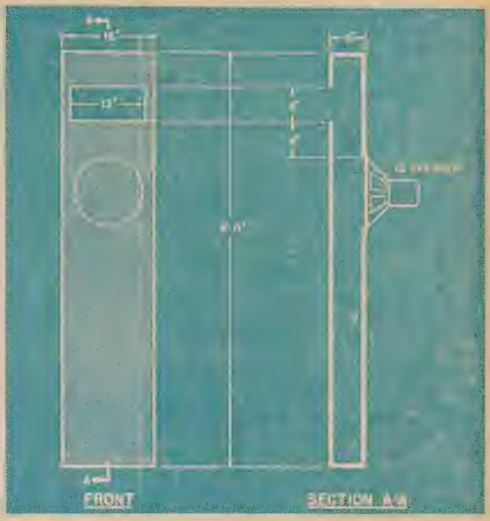
WRITTEN in a colloquial "de-bunking" style, Flewelling's article dismisses as unimportant all the discussion about triodes v. pentodes, &c., and deals just about as lightly with matters of linearity and intermodulation.

Recognising many programmes for what they are worth, he claims that the bass end is the foundation of music and on it the home listener can build an inexpensive but a pleasing amplifier.

SIMPLE CIRCUIT

Flewelling's amplifier is a designedly simple affair with variable feedback which can be set to give the best balance of gain &c. with the particular speakers and components in use. It is intended to feed multiple speakers.

Flewelling apparently doesn't like high fidelity speakers on principle or horns of any description. His pick is half a dozen cheap speakers operating together. From the upper half of the dividing network he runs in parallel a tweeter, a 6-inch and a 12-inch speaker, mounted on any old baffles.



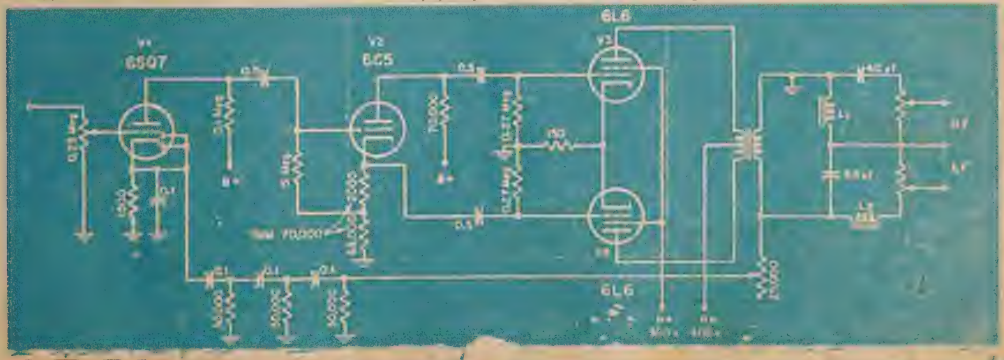
The suggested baffle system for the bass speaker. Some enterprising constructor with a surplus of time and pine boards may like to try it out.

From the lower half he runs the bass speakers—a 12-inch unit in an air column and two 8-inch speakers mounted on any convenient baffle area. All speakers have 6 to 8 ohm voice coils, and are mounted behind furniture or expanses of cloth which gives no clue as to the position of the cones. An important psychological point!

The dividing net uses electrolytic condensers and chokes involving 400 turns of wire on (presumably) a speaker transformer core. What does it matter if the crossover is at 350 or 450 c/s, says the author?

Centrepiece of the set-up is an original baffle which is a cross between a vented enclosure and an organ pipe. The box encloses the unwanted high frequency output from the cone and allegedly derives benefit at the low end from the speaker working "across" rather than "through" the air column.

The box is made of plain ¾-inch pine boards assembled with screws.



The amplifier circuit is fairly conventional apart from the large values of coupling condensers and the unusual feedback circuit. The diodes play no part in the circuit, being merely connected back to cathode.

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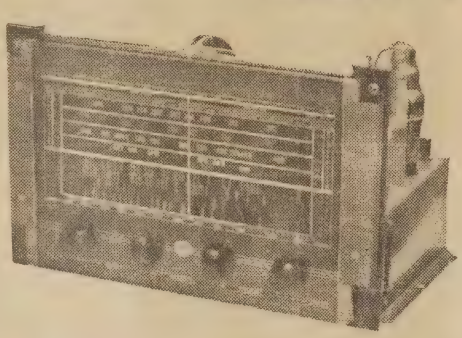

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THE LATEST—AN ELECTRONIC SECRETARY

A Swiss engineer, Jean Dreyfus-Graf, has developed an instrument capable of writing speech directly into characters resembling shorthand. Though it cannot yet rival normal voice recorders, the inventor's ultimate aim for his "Sonograph" is a device which automatically types the spoken word.

THE Sonograph principle is fairly simple. It divides human speech into a number of frequencies by a series of filters and the output of each filter is fed to one of the cylindrical solenoids shown in Fig. 1.

Magnetic shafts extend into the solenoids. The outside end of each shaft is attached to the pen, which traces a line on the moving cylinder. As each solenoid pulls the pen toward it, the pen traces a line in that direction.

The final character drawn is the resultant of all the pulls—all the sounds at different frequencies — passed from the microphone through the filter system to the solenoids.

So far, the Sonograph sounds familiar. All this has been done before —for example, in the Bell Laboratories Visible Speech, but this apparatus introduces a couple of new principes.

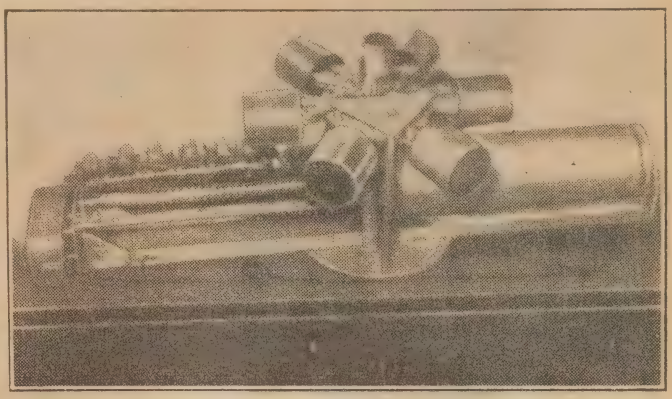
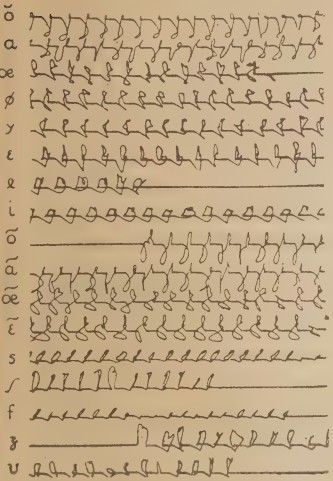


Photo of the tracing apparatus showing the solenoids mounted on top.

One example of the symbols produced by this system.



Another example showing the result of common sounds being repeated several times.

First, since it is the human voice we want to reproduce, the filters are made to reproduce the frequencies most commonly found in human speech.

Vocal cords vibrate at a fundamental frequency between 100 and 400 cycles, depending on whether they belong to a deep-voiced man or a sharp-voiced woman.

The mouth acts as an orchestra of several resonators, with frequencies around 200, 500, 1000, 1500, 2000 and 3000 cycles. These are widely separated from each other. So, our phonetic wave train is like a concert of six principal sinusoidal waves, among which certain ones are reinforced at will by the speaker.

The Sonograph's six filters are designed to pass these six principal frequencies. This humanises the instrument, as compared to other types of sound analysers which simply split the spectrum into slices without reference to the peculiarities of the human voice.

Each of the cylinders responds to one of these main frequencies, making the pen follow the voice.

A second new feature of the Sonograph is that it uses only part of the train of waves which makes up any given sound.

Sounds can be divided into three parts: an initial increasing portion, a centre part almost uniform in strength, and a falling-off part as the sound finishes.

NEW CHARACTERS

By using only the initial rising and the final falling, a sharp "character" like a letter of the alphabet is formed. Specimens of these "letters" are seen in Fig. 2.

So-called "continuous" sounds are really over-and-over repetitions of the same sound elements. Vowel sounds like "o" or "e" appear as a string of similar letters, as do also continuous consonant sounds like "s," "f" and "l." Each element in the continuous sound appears as a separate character.

The system of six selective filters gives us an instrument which pays attention to the human voice and plays down other sounds, making it produce strong signals when actuated by the voice.

Selecting only the rising and falling portions of each sound makes the machine produce definite characters of the type people are used to reading, rather than wavy masses of light and shade.

VOICE TYPING

These two factors in combination produce a machine which will be adaptable to practical use.

Of course, the stenographer must learn to read the characters of the machine. That should not be harder than learning a shorthand system, and would have the great advantage that the Sono-stenographer could do other work while letters were being dictated.

The Steno-Sonograph, as the machine has been tentatively named, is not yet perfected for general use, though an experimental model has given good results.

Meanwhile, a variation now being constructed—the Typo-Sonograph—would make the stenographer unnecessary altogether. Instead of pulling a pen this way and that, the solenoids actuate differential relays in such a way that a typewriter key is depressed for each distinct sound. (From "Radio-Electronics")

RECORD PLAYER

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GOLDRING PRESENTS A RECORD PLAYER which will never become obsolete whatever speed may ultimately be used for DISC RECORDING.

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- Independent on-off switch.
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THE GOLDRING THREE-WAY PICKUP (No. 150)

HIGHEST FIDELITY REPRODUCTION.
Easy change from 78 rpm to 33 1/3 rpm by simply changing color coded stylus and moving weight adjustment.

OUTPUT : 150 mV.
FREQUENCY RANGE : 30—16,000cps
STYLUS PRESSURE : 14 grms (78 rpm)
: 7 grms (33 1/3 rpm)
OPTIMUM LOAD : 50,000 ohms
SAPPHIRE STYLI (supplied with PLAYER)
BLUE : 0.003" for Standard Records
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ORANGE : 0.0035"

THE DUO-SPEED MOTOR

Ideal for playing both standard and long playing records.
Rim driven 4 pole motor of advanced design assures low rumble.
No stray field radiation.
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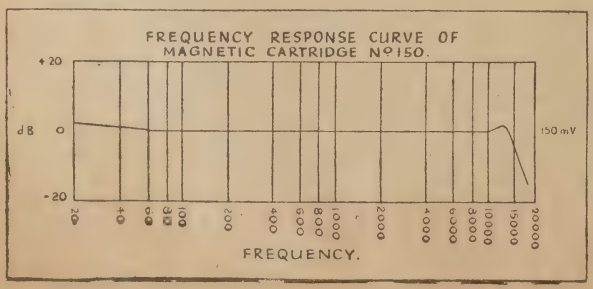
Speed change from 78 to 33 1/3 rpm effected in a few seconds by merely reversing main pulley drive.
10" HEAVY PRESSED STEEL TURNTABLE
Supplied connected to 200/250 volts but change to 100/125 volts is accomplished easily.

PLEASE NOTE: The unique design of this PICKUP using stylus as ARMATURE does not permit use of other styli or needles. 45 rpm RECORDS when available will be played with same stylus and weight as 33 1/3 rpm records.



Should records using any other speed become available, adaptors will be supplied at small extra charge.

Design of suitable pre-amplifier and equaliser supplied with each player.

Price £17/15/- (Inc. 25% Sales Tax)
(Interstate slightly higher)

KALEIDOSCOPE GIVES GAY PATTERNS

Invented more than 130 years ago, the kaleidoscope is an optical instrument that never fails to interest and intrigue. The name is derived from three Greek words, kalos, "beautiful;" eidos, "image;" and skopein, "to view."

BY a simple arrangement of mirrors, the kaleidoscope converts a few pieces of colored glass into delightful and complicated patterns of endless variety.

Illustrated in this diagram-sketch is perhaps the simplest form of kaleidoscope. It consists essentially of a cylindrical tube about a foot in length, inside which are two strip mirrors running the length of the tube and joined edge to edge to form an included angle of 60 degrees.

The top end of the tube is closed but has an eyepiece in the centre for viewing.

CONSTRUCTION

The other end is closed with a revolving cap consisting of two discs, one of clear glass and the other of ground glass. Beads and fragments of brightly-colored glass or other material lie loosely in the space between these two discs.

When the kaleidoscope is turned to the light, these scraps appear to the viewer as six groups, symmetrically arranged in a striking pattern formation. The original image is reflected in each of the mirrors and then reflected back again, so that in addition to seeing the actual glass fragments the observer sees five other images, making a sixfold design.

The combination of the six representations forms a symmetrical pattern which changes whenever the disc is turned to rearrange the glass fragments.

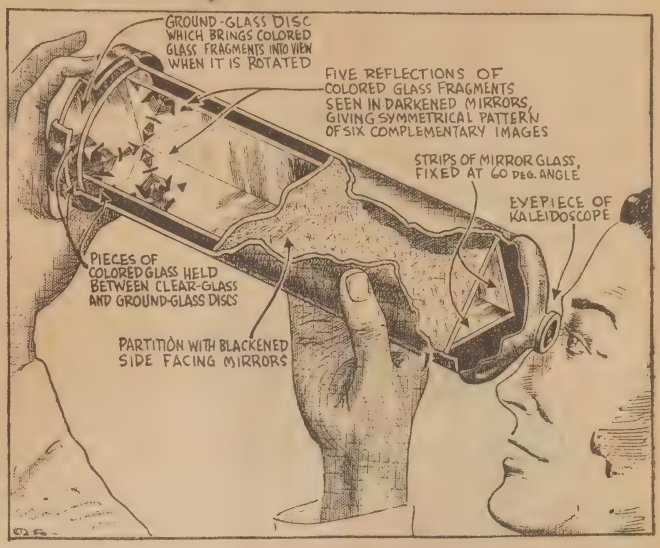
By reducing the angle of the mirrors to a smaller aliquot part of 360 deg., the number of images is increased.

ENDLESS VARIETY

The variety of patterns or designs that are created with the kaleidoscope is virtually limitless, for not only can the number of repeated images be varied but the number, shape and color of the fragments between the glass discs can also be changed.

Various modifications of the kaleidoscope have been developed since the instrument was originally invented by Sir David Brewster, the Scottish scientist, in 1817. Among the variations are the polycentral and polyangular kaleidoscope, the hexascope, and the tetrascope.

Such instruments are used by designers in working out patterns for fabrics and carpets, and even for wallpaper designs.



ABOUT POLARISED LIGHT

(Continued from Page 13).

When this picture is projected on a screen and viewed through the special spectacles, a wonderful three-dimensional effect is obtained.

These films were made by taking a pair of stereoscopic negatives which are really two pictures of the same subject taken from slightly different angles — and printing them on a special film with a relief gelatine coating. Another film is sandwiched between these two films and the picture transferred from them to the third film by pressure.

The result is one film with a picture on each side, one slightly out of register with the other. One picture is polarised for one lens of the special viewing glasses and the other for the second lens.

When viewed through these spectacles each eye sees its own special picture and the brain fuses them into one three-dimensional picture.

The films were used during the war to train gunners in bombarding enemy territory which had been previously photographed.

When certain crystals, glass and many plastics are sandwiched between two sheets of polarising plastic and the sheets illuminated, fantastic colors are generated as the plastic sheet is revolved.

This property has been used to produce some wonderful effects for decorative purposes by having a small motor attached to one of the sheets, revolving it slowly, thus producing a variety of color changes.

An important use in industry of this color-changing property is in the examination of glass and plastic materials for flaws.

GLASS STRAIN

Bottles and other objects are examined under the "polariscope" for strains brought about by defective manufacture or annealing. The weakened parts appear colored.

Architects are using this method to determine in advance what strains and stresses are likely to occur in building materials. For this purpose, models of a project are made from plastic and subjected to the identical strains likely to be encountered in the finished job. Examined under polarised light, the strains are evident and can be allowed for in the final construction.

(Continued on Page 95)

It's as easy as falling off a log

TO MAKE AND PLAY YOUR OWN RECORDS, EITHER STANDARD OR MICROGROOVE, WITH A BRS B-12-D RECORDER, AND PLAYBACK UNIT

YES, it's literally as simple as that. You don't have to be a technical expert, with years of recording experience behind you to make your own records. The BRS R-12-D unit takes care of all the technicalities—all YOU have to do is flick a switch . . . make a simple foolproof adjustment and the R-12-D does the rest—and does it so well you'll have a difficult time trying to pick a record of your own making from a professional job. You can have more fun with a BRS R-12-D unit than you've ever imagined. Your friends can share in the fun, too. Ask your local Radio dealer for a demonstration—you'll be absolutely amazed at the results.

MICROGROOVE

Cuts costs of Discs by 75 per cent.

Microgroove recordings, which are recorded and reproduced at 33-1/3rd rpm., have four times the capacity of ordinary standard groove discs. This makes it possible to record 8 three-minute numbers or one complete short work on each Microgroove recording, resulting in a 75% saving on discs.

Apart from longer playing time and savng in space and cost, Microgroove being cut at lower recording levels gives infinitely better reproduction. This is particularly noticeable in increased high frequency response with less distortion.

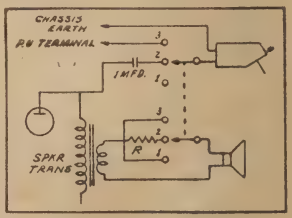
The extremely low noise level of BRS discs make them ideally suited for Microgroove use, the noise being still far below that of standard pressings. MICROGROOVE is the last word in sound recording technique.

The BRS R-12-D Unit

1. Makes and plays its own records.
2. Plays ordinary commercial records.
3. Is easily fitted to any standard Radio, Radiogram or amplifier.
4. Provides 2-speed recordings — 33-1/3rd or 78 rpm.
5. So simple, even a child could operate it.
6. No adjustable parts necessitating service.
7. Mantains its characteristic high-quality for years.
8. Available for either standard groove or microgroove.

Easy To Instal

The installation of the R-12-D can be easily and cheaply effected. All you need are a few low-cost components and this simple circuit diagram.



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NEWS AND VIEWS OF THE MONTH

Television tenders

THE fact that tenders have closed for the Sydney television station does not mean that the Government is in a position to make up its mind overnight and instruct the successful tenderers to go right ahead.

To the layman, and, indeed, to the big majority of executives and committee members, the tenders will represent only a mass of unintelligible technical detail. Before any final recommendations can be made by the Standing Committee on Broadcasting to the Federal Government, the tenders will have to be sifted by technical experts and the arguments for and against translated into a plain-language report.

This will be an unenviable task for the Government's technical experts. Wading through the mass of material, covering a complete television installation, they will not have the benefit of long experience or of clearly defined rules as to what is good and bad. Neither will they be sure of the ultimate requirements of the system.

From the welter of argument overseas about standards and color, definition, programme material and so on, they must envisage what looks like the best technical policy, tie it in with probable costs and then choose equipment with an eye to maintenance and its adaptability to change.

The ease with which changes can be effected will be an important consideration in the initial equipment which, at the outset, anyway, must be regarded as experimental. While the tentative standards are up-to-date right now, there is every chance significant developments in technique will have taken place by the time programmes are ready for the air.

If current research in America on compatible color comes good, it may even be desirable to insert provisions into the system for eventual color transmissions.

One thing is certain—we won't be able to change the system once the production lines begin to roll. We must see that Australia has an up-to-date and a uniform set of standards when the Government finally says "This is it."

LENGTHY PROCESS

Weighing all these matters, the technical sub-committee cannot be expected to reach a quick decision. By the time its recommendations filter through other committees, &c., and on to Cabinet for ratification, quite a few months will elapse.

After that will come the problem of supplying and erecting the initial station in the face of a munition speed-up. The Federal Government IS definitely going on with television, we are assured, but you won't have to keep your evenings free for quite a while yet.

The most recent statement attributed to those who might know, is that the first station on the heights of North Sydney should be well under way in early 1952.

Meanwhile, stories about the TV "revolution" in the US continue to filter through. A terrific battle is waging in the courts and in laboratories over color, about which we've already had plenty to say.

From another angle, Hollywood interests are seriously worried by the TV threat in either form. Movie audiences have continued to shrink, and large companies, notably Fox and Paramount, are sinking millions into television "just in case."

Locally, the huge Hoyts' theatre chain apparently has eyes on commercial radio, having already acquired a substantial interest in 3XY. According to manager Ernest Turnbull, the move will allow the chain better "to keep abreast of developments in television and commercial broadcasting."

The big commercial stations are themselves watching the position closely because television, like nothing else, could drain off their profitable evening audience. But that's about all commercial interests can do at the moment. With possible changes in Government and policy, there's no guarantee that we will ever have commercial television in Australia. Even then, it is problematical whether the licences would go to established networks or whether the networks could sink enough into the project in the hope of showing an ultimate profit.

New landing gear

COST of new aerodromes in country districts will be greatly reduced if civil aviation authorities approve a new-type landing gear to reduce the hazards of a cross-wind for landing.

Official tests with the crosswind landing gear have been made chiefly at Essendon, Melbourne, and further tests are now planned at Kingsford Smith Airport, Mascot.

If the gear is then approved, it

POPULAR SCIENCE QUIZ

Q.—We often refer to the Galaxy. Can you describe it?

A: The galaxy is a huge system of some 100,000,000,000 stars, of which our Sun is one. It has roughly the shape of a grindstone. Its diameter is about 58,000 light years, according to a recent estimate. (A light year, the distance light travels in a year, is nearly 6,000,000,000,000 miles.) Since the Sun is a little below average size for stars, the total mass of the galaxy is estimated at 200,000,000,000 times that of the Sun.

The entire Solar System is about 19,000 light years from the centre of the Galaxy, which lies toward the constellation of Sagittarius. We are revolving about the centre, at a speed of 200 miles per second, which will take us once around in some 220,000,000 years.

The effect of the Milky Way is obtained when we look toward the outer edge, for then there are many more stars in our line of vision than when we look toward the flat sides.

Q.—What is the best way to train one's memory? Does it help to memorise long list of facts?

A: Authorities say that the term "memory" is dropping out of our psychological terminology. We now speak more functionally of the capacity for memorising. Probably it can be applied but not appreciably improved. What this means is that memorising long lists of facts as such is of little or no value.

What is valuable is memorising materials in the field in which the person needs to memorise. The only person who would profit by memorising telephone numbers is someone who had to remember telephone numbers. If he needs to memorise research data, that is what he should practise with.

The apparent improvement is due to increased organisation of the data of this field—that is, he has more things to tie to—and not to improvement of some mythical faculty called "memory."

Q.—Why it is that radio waves can travel all the way round the the earth?

A: There is a layer of gases high in the atmosphere made of partially broken, or "ionised," atoms and these bend the radio waves down and send them back to earth again. This so-called Kennelly-Heaviside layer is really several separate layers. Very short radio waves, like those used in television, ordinarily pass right through and hence they cannot be received at great distances from the transmitter.

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IMPROVED APPEARANCE The original Plastic Cabinet has been redesigned along more modern lines. Vastly improved in appearance, and more durable than ever before.

IMPROVED CIRCUIT The main improvement here is the inclusion of the new Radiotron series of Valves: X61M, 6AR7GT, KT61, 5Y3GT Rectifier.

IMPROVED PERFORMANCE By the inclusion of these new Radiotron Valves, the sensitivity is increased tremendously, and the usual Aegis high standard quality I.F.'s Coils, etc., make the Metropolis "4" a true winner in Mantel Kit Sets today.

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will enable aerodromes, particularly outback airfields, to operate with a single runway instead of a minimum of two runways.

The gear has castor-type wheels which roll in the direction of any force exerted on them in landing or take-off.

Accordingly, the wheels may not face the direction towards which the plane is heading, although they work automatically for a straight landing roll.

Tests have proved that a DC3 airliner can take off with the new gear while a 40-45 mph wind has prevailed at a sharp 90 degrees across the runway.

Tests of the gear in Australia are likely to be restricted to DC3 airliners and lighter planes for some time, although larger planes have used the equipment for safety experiments in London and New York.

Over the poles

THE phenomenal progress in civil aviation was highlighted by a recent announcement that the Chicago Adventurers Club has chartered a Constellation airliner to take them on a round-the-world jaunt, over both poles. It is not so very long ago that men gave their lives in a heartbreaking attempt to make similar journeys on foot.

The plane was scheduled to take aboard 10,000 gallons of petrol in New Zealand, then hop off for Capetown by way of the South Pole.

Going north to London, the plane will then fly over the North Pole back to Chicago.

Robot brain

A HUGE electronic "brain," believed to be the most advanced of its kind in the world, has been built for the British Government by a team of Manchester engineers.

This was disclosed by Professor F. C. Williams, the Manchester University scientist who designed it, at the International Conference on Robot Machines in Paris.

The "brain" is 50 feet long, seven feet high and contains 3500 valves.

It obeys 3,000,000 orders in one hour.

It can add up a column of 500 numbers in the time it takes to say "addition."

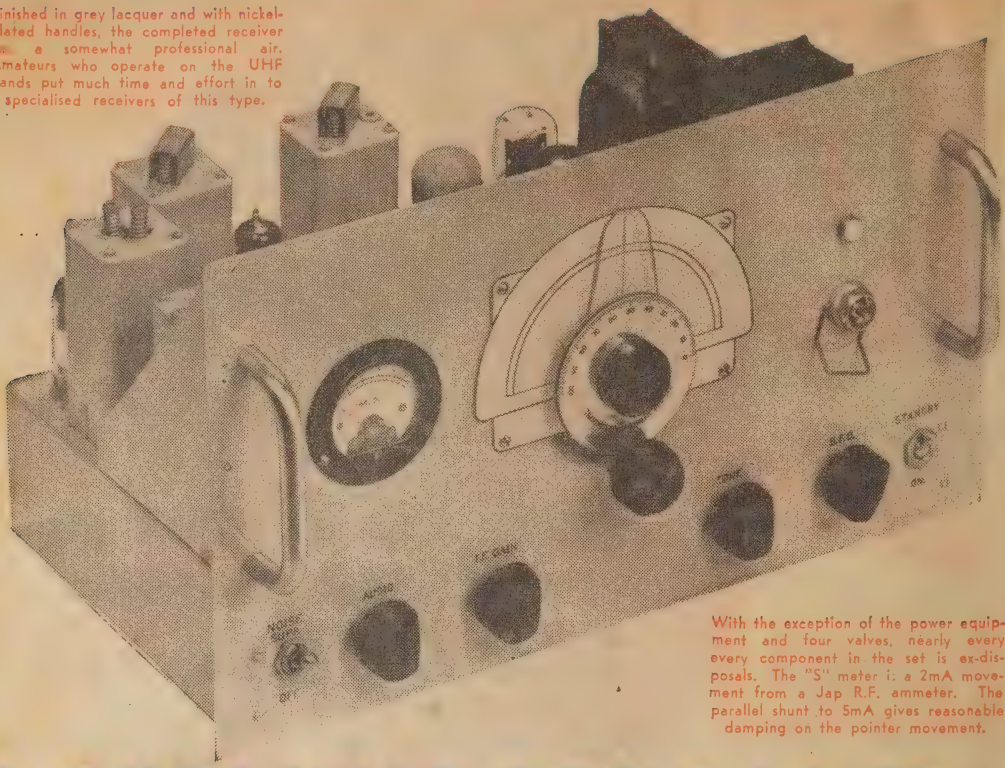
Equipped with the best robot memory yet invented, it can keep up to 16,000 12-figure numbers "in its head."

When full-out, the "brain" gets so hot that a continuous airblast is needed to keep it cool.

The Government financed the project because the "brain" will be of great value in defence research, for example, in working out details of aircraft design.

Banks may also use the "brain."

There are some 2,000,000 domestic refrigerators in use in Britain today. In estimating that each saves about 2/6 worth of food from spoilage a week, experts reckon this makes a total saving of about £12,000,000 a year.



Finished in grey lacquer and with nickel-plated handles, the completed receiver has a somewhat professional air. Amateurs who operate on the UHF bands put much time and effort in to specialised receivers of this type.

With the exception of the power equipment and four valves, nearly every every component in the set is ex-disposals. The "S" meter is a 2mA movement from a Jap R.F. ammeter. The parallel shunt to 5mA gives reasonable damping on the pointer movement.

A SUPERHET FOR 144 Mc.

First and foremost, this article details the construction of an effective 2-metre receiver. As a side issue it gives many useful pointers to the application of the new miniature tubes and disposals type components in V.H.F. gear. The tuner arrangement could be adapted directly for the FM or television band.

THE gradual drift of amateurs to the higher frequencies has just about established the 144 Mc. band as a standard for cross-town and cross-band working.

Quite apart from "privacy" and the lack of interference, the band provides an excellent opportunity for amateur and others to gain a practical working knowledge of U.H.F. circuitry. With some reservations, many of the techniques which work well on 144 Mc. will be applicable to future television receivers.

THE FRONT END

We had this thought strongly in mind when we built up this particular set. As much as anything, we wanted to evolve a simple but effective tuner and observe things like frequency drift, and noise level under typical conditions.

One can dream up fancy R.F. ends with push-pull, neutralisation, multiple stages and the like, which may work well if properly built and adjusted. Many amateurs have put in a lot of work along this line and achieved excellent noise figures.

While very interesting for the particular job, it is pretty obvious that television front end design will follow along simpler lines. A certain standard of performance will be necessary, of course, but the emphasis will be on economy, simplicity and reliability.

One could certainly not imagine anything much simpler or straightforward than the tuner suggested, using a R.F. pentode amplifier and a twin triode as a mixer-oscillator.

by W. N. Williams

With due care in construction, there should be no difficulty in getting immediate results and the performance could be bettered only by a much more elaborate set-up. The set will give a good account of itself using a simple dipole. With a beam, the signals are really strong.

NEW CONDENSERS

It was decided at the outset to build the tuner on a separate sub chassis, which could be removed, modified or replaced altogether without disturbing the remainder of the receiver. It leaves open the possibility also of using copper chassis for this portion of the set, ensuring effective earthing.

The remainder of the set, I.F. channel, audio system and power supply, is an excellent basic unit for any V.H.F. work, for 144, 288 or even

576 Mc. operation. The tuner could obviously be used on its own as an excellent converter.

In planning the tuner, we pre-supposed the use of the new multiple R.F. bypass condensers, which are now appearing on the local market. Intended for all U.H.F. applications, the tiny condenser elements, up to three in number and with a capacitance round the 1000 pf. mark, are formed around a tiny ceramic pillar, barely one-eighth inch in diameter and about a half-inch long.

Some are intended to bolt directly to the chassis while others have a common return pigtail which is soldered into the wiring.

WIRING SIMPLIFIED

In practice, the multiple condensers can be earthed to a convenient spot on the chassis or to a specific cathode connection and the separate active leads taken, as necessary, to the cathode, heater, screen, plate decoupler and so on. Normally one or two such condenser units, occupying a minimum of space, can provide all the bypassing necessary for one complex stage. They are generally more effective than the individual mica types they replace.

In keeping with the small condensers, most of the resistors selected for possible use were the tiny quarter-watt (or less) types "won" from various disposals items. It is doubtful whether one could build a really efficient tuner for the 140 to 200 Mc. region if limited to conventional full-sized components. The job would certainly be a lot harder, at any rate.

Beginning with the frequency changer, the most likely looking tube at present available is the 12AT7 twin triode. Similar to the highly rated 6J6, it has separate cathode leads for the two sections—a most important modification.

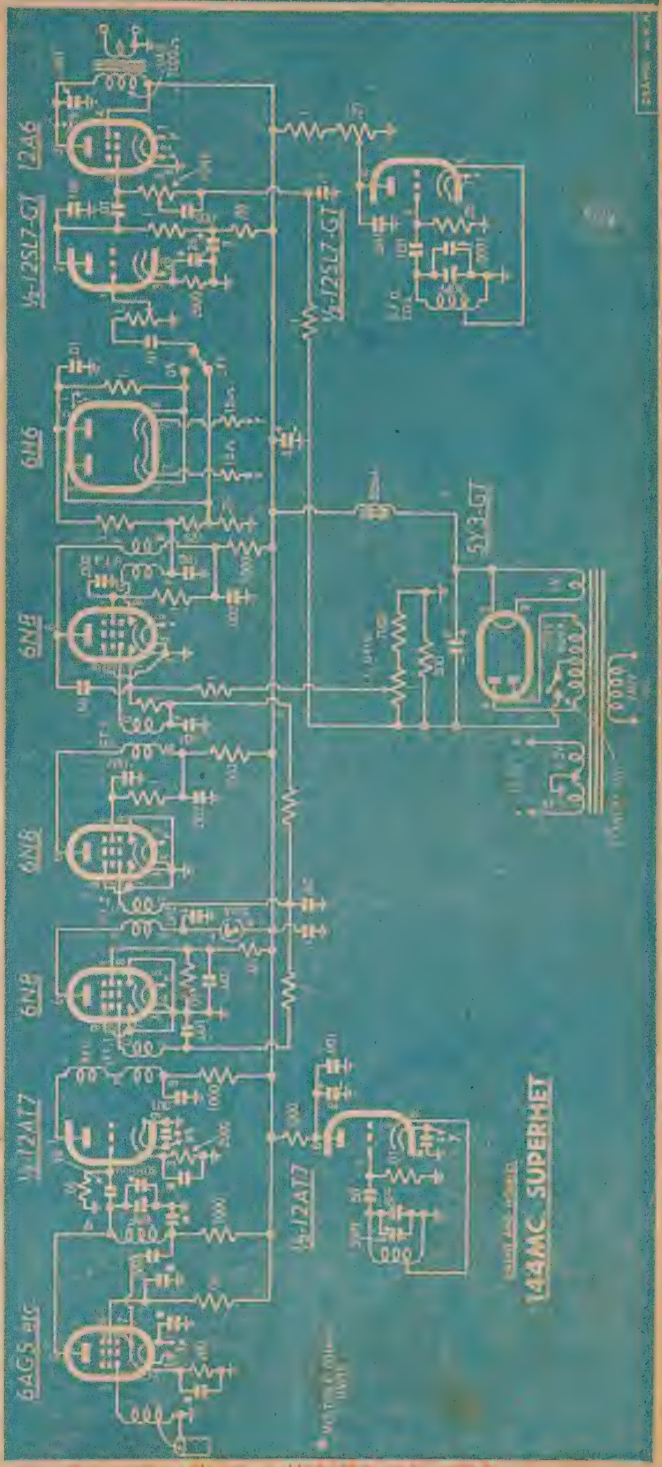
The tube lends itself well to push-pull mixer and oscillator applications but we were anxious to test its performance as a simple frequency changer, one section being used as a mixer, the other as an oscillator.

RF SUB-CHASSIS

In this connection, the General Electric Co. of America recently published a circuit showing the 12AT7 in just this service at 100 Mc., and with one section as a normal cathode tapped oscillator. The idea apparently had something to commend it.

A small sub-chassis was accordingly made up, comprising a channel section measuring 3" x 1 1/8" deep x 4½" long. Underneath there was space to mount a tag strip, terminate the supply leads and install the less important decoupling components.

The tuning condenser was mounted on top and a vertical 1½" panel was installed, which would carry the valves on their sides with the pins facing the condenser. All the "hot" condensers and wires run directly to the sockets and across the intervening space, no lead being more than a fraction of an inch long.



For F. M. and Television

The new Noval (9 pin) type Double Triodes and Triple Diode Triode.

The 12AT7 is featured in the receiver for 144 megacycles described in this issue.

With the rapid developments that are taking place in the F.M. and Television fields, amateurs everywhere will welcome the availability of these British-made Brimar Valves that already have proved their quality and reliability in thousands of Television Receivers in England. Brimar leads the V.H.F. field.

12AT7 *Double Triode (High Slope).*
Separate cathode connections and tapped heater features enable this type to be used in a variety of applications. As a frequency changer it will operate at frequencies up to 300 MC/S.

12AU7 *Double Triode (Low Mu)*

12AX7 *Double Triode (High Mu)*

6T8 *Triple Diode Triode*
This type is particularly suitable for use in discriminator circuits and for delayed A.V.C. application.

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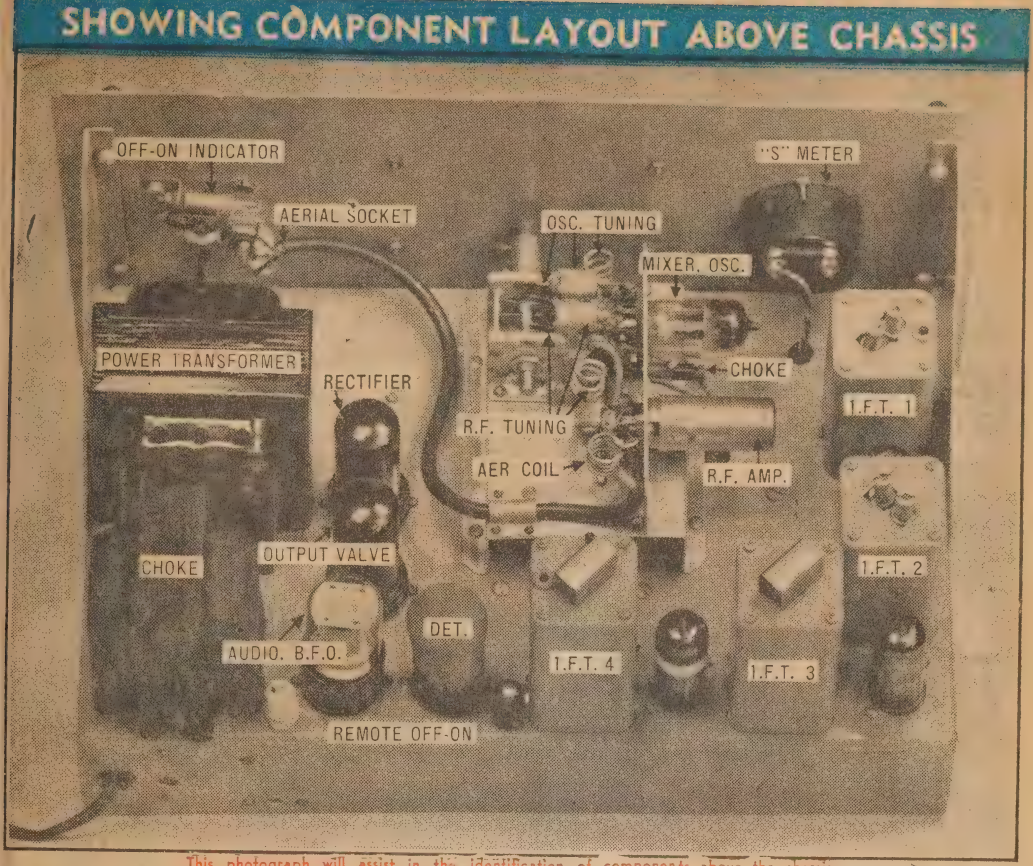
SHOWING COMPONENT LAYOUT ABOVE CHASSIS



This photograph will assist in the identification of components above the chassis.

Slug tuning is often employed at these frequencies but, in this case, it seemed easier to use a small condenser rather than contrive a mechanism to manipulate a couple of slugs and keep them in track.

The condenser selected was a midget 2-gang, taken from an ex-disposals I.F.F. set and having two moving and two fixed plates in each section. The inner moving plates were removed, leaving one moving and two fixed plates per section.

The oscillator coil comprises three turns of 16 gauge tinned copper wound to an inside diameter of 5/16" and spread to ¾" overall. This was soldered directly across the front section of the tuning condenser and the earthed side linked by some fine braiding to an earth point on the chassis midway between the condenser and the 12AT7 socket. This earth point forms the return for the entire oscillator circuit.

MIXER GRID COIL

The mixer grid coil has 3 turns of 16 gauge tinned copper, 3/8" inside diameter and 5/8" long, but the low potential end is not connected directly to the condenser frame. The return is through a .001 mfd condenser to a second earth point, which serves the mixer circuit. This arrangement allows the coil to be connected directly in the plate circuit of the R.F. amplifier.

This circuit is peaked with a 6 pF. air trimmer, one of the concentric variety but lacking the internal sleeves which are found in the more usual 30 pF. trimmers. Since the signal circuit must tune to 144 Mc., it needs considerably less parallel capacitance than the oscillator tuning.

THE R.F. STAGE

We checked the 12AT7 on its own as a simple converter but the results were disappointing. There was an obvious lack of "front end" gain and a marked tendency for short-wave stations in the 10 Mc. region to ride through into the I.F. channel. Even if the signals are not very strong they can cause troublesome heterodyne effects with 144 Mc. stations being received in the approved fashion.

A further very practical objection to the one valve converter idea is that it allows a good deal of oscillator radiation and may cause interference with other services in the particular part of the spectrum.

As a further step, we wired in a 6C4 triode as a grounded grid R.F. amplifier, supplying the plate through the coil already provided and coupling the aerial into the cathode. The performance was immediately improved but the front-end gain was still obviously low.

The same socket was duly rewired to take a pentode R.F. amplifier, of which a variety of types are available. We ended up with a 6AG5, mainly because we had two or three on hand.

A couple of new types are projected for television R.F. service and intended for use at 200 Mc., being more like the popular 6AK5 but fitted with a 9-pin base and adapted for mass production technique. The better the valve you select, the better will be the performance, particularly in regard to noise factor.

Actually any good H.F. pentode, even the 9003, will give better R.F. gain than a simple grounded-grid triode and, for the high-slope types, the difference is very obvious. The noise factor is much the same in practice, the inherent advantage of the triode structure being offset by the complete lack of step-up in the aerial coil.

STABILITY

The most serious rival to the R.F. pentode is likely to be the two-stage "cascode" amplifier for which the 12AT7 is again well suited. It is

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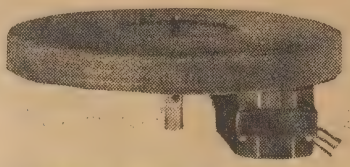

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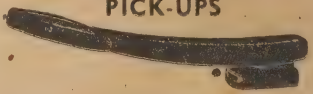

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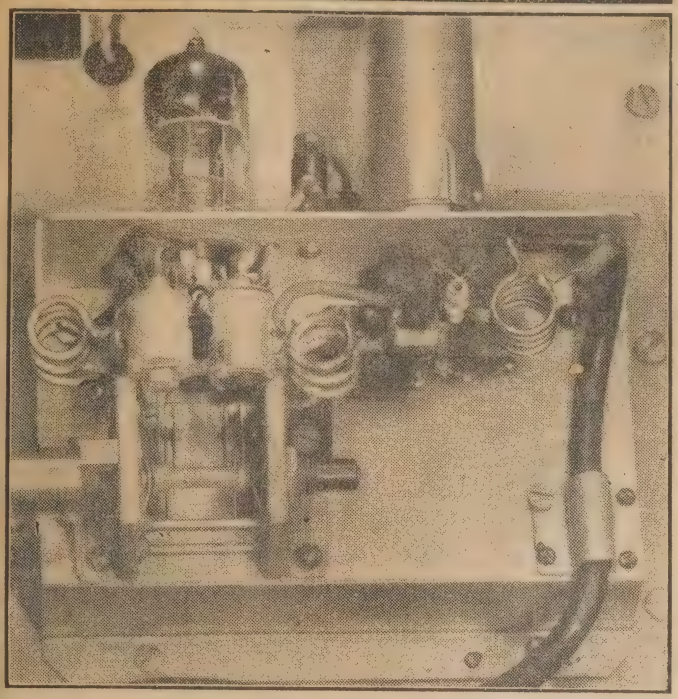
CLOSE-UP OF THE R.F. END OF SET



The RF end features a pentode RF amplifier at the right coupled to a twin triode mixer at the left. The RF stage is untuned.

more complicated than the pentode circuit and allegedly more critical but it has a better noise factor and slightly more gain. We will probably have more to say about this circuit at a later date.

The secret of obtaining stability and performance from an R.F. pentode centres largely round the arrangement of the input and output circuits and the placement of the bypass condensers. As we have already pointed out, the task is greatly simplified by the use of the new midget multiple condensers combining, in one popular form, three .001 mfd. units on the one leg.

In our case, we fed the plate through the following tuned circuit and there are actually two condensers running to the earthy end of the coil. One is located at the common earth point for the mixer and is physically as well as electrically part of the tuned circuit. The other runs from the bottom of the coil back to the nearest end of the R.F. cathode, to provide a direct path for the output currents.

The other end of the cathode is bypassed to an earth point on the opposite side of the socket, forming the return point for the grid coil and the coaxial input cable. There is thus a fair degree of segregation of the input and output circuits—a consideration which effects stability, gain and signal-to-noise ratio.

The grid coil has 4 turns of 18 gauge tinned copper, wound to an inside diameter of ⅜" and sprung out to about ½". Actually it is intended to be self-resonant and, being loaded by the aerial and the grid input impedance of the valve, it has a fairly flat response. There is no need for separate tuning to cover the band from 144 to 148 Mc.

AERIAL PEAKING

The aerial is best peaked with the aid of the signal strength meter, the turns being squeezed or opened out for maximum response. Observations of both gain and noise can be used to set the optimum point for the aerial tapping. In the original receiver, we settled for 1 turn from the earthed end.

Operating under these conditions, the tuner gave a good account of itself on the 144 Mc. band using, at the outset, a simple horizontal dipole. Various amounts of coupling were tried between the mixer and oscillator circuits but it appeared that there was sufficient injection through the normal stray coupling between the circuits.

During the preliminary tests, the tuner had been operating external to the main chassis, being connected to it by leads the best part of a foot long. These included an earth and a B-plus lead, also the two active 6.3 volts leads having 12.6 bolts between the outer terminals. The full 12.6 volts was applied to the

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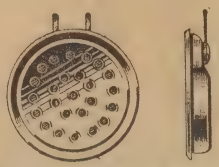

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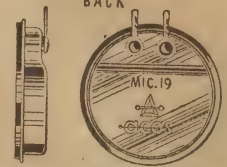

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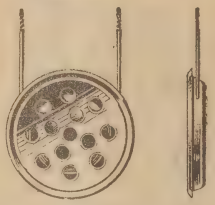

MIC. 18 MICROPHONE SPEECH INSERT provides high acoustic qualities with minimum bulk. Where exceptional slimness is required, this Insert is recommended.
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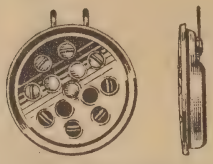

MIC. 14 STANDARD SPEECH MICROPHONE INSERT with nickel-plate brass case which gives high corrosion resistance, mechanical strength and rigidity.
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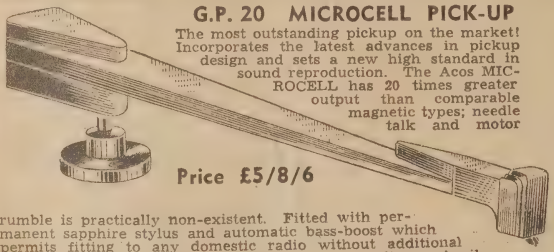
G.P. 20 MICROCELL PICK-UP



The most outstanding pickup on the market! Incorporates the latest advances in pickup design and sets a new high standard in sound reproduction. The Acos MICROCELL has 20 times greater output than comparable magnetic types; needle talk and motor rumble is practically non-existent. Fitted with permanent sapphire stylus and automatic bass-boost which permits fitting to any domestic radio without additional equalisers. Plays Microgroove or ordinary recordings.
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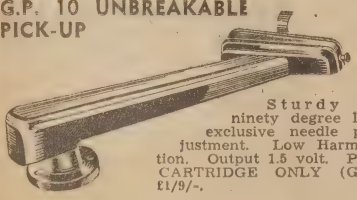
G.P. 10 UNBREAKABLE PICK-UP



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Sturdy construction ninety degree lift-back and exclusive needle pressure adjustment. Low Harmonic Distortion. Output 1.5 volt. Price: £2/13/6.
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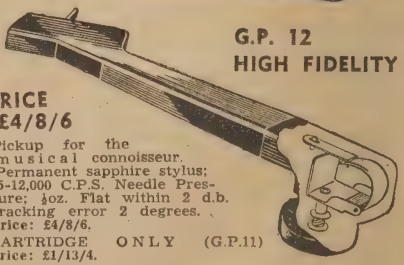

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Pickup for the musical connoisseur. Permanent sapphire stylus; 25-12,000 C.P.S. Needle Pressure; ½oz. Flat within 2 d.b. Tracking error 2 degrees.
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SOLE AUSTRALIAN REPRESENTATIVES

12AT7 and 6.3 volts only to the 6AG5.

The plate and B-plus lead to the first I.F. transformer were twisted together and limited to about 9 inches.

When the tuner assembly was ultimately installed on the main chassis and the various leads trimmed down to minimum length, it became hopelessly unstable.

The reason for this was not immediately apparent until we realised that the triode mixer was itself likely to oscillate. When it did so, the I.F. channel was completely blocked by spurious beats and no amount of decoupling and bypassing made the slightest difference.

MIXER OSCILLATES

The key to the situation is that the triode mixer will oscillate if the plate wiring external to the I.F. transformer winding is naturally resonant at somewhere near the signal frequency. When this happens, the mixer simply behaves as a T.P.T.G. oscillator.

Where the layout is dictated primarily by the requirements of the signal circuits, it is not always easy to keep the mixer plate lead so short that its resonance is far above a signal frequency in the 144-200 Mc. region. It was certainly not so in this case.

Accordingly, we tried the opposite approach of loading the plate lead, right near the plate pin, with a small R.F. choke, with the idea of shifting the resonance the other way. Connection of the choke into the plate circuit completely stabilised the mixer without any apparent effect on the conversion gain.

The exact design of the choke did not appear to be critical, although some chokes gave slightly higher conversion gain than others, presumably due to partial regeneration and/or to the change in loading reflected back to the grid circuit.

The one actually used was taken from an English disposals equipment. It has about 20 turns of 30 gauge enamel close wound on a ¼" diameter rod.

DECOUPLING

A further precaution which has a bearing on stability is the position of the decoupling condenser to the I.F. primary. We found it desirable to run the B-plus lead back to the tuner and bypass it at this point, rather than to the main chassis. After all, it is the logical way to complete the plate circuit of the mixer. So much for the tuner.

Though intended to operate into an I.F. of about 10 Mc., the figure could be varied over a considerable range by raising or lowering to oscillator frequency.

The I.F. channel (or the receiver serving as such) should not be too sharp, owing to possible difficulties with tuning and frequency drift. A further point is that a sharp channel will not accept the frequency modulation characteristic of the many

(Continued on Page 83)

A HIGH-GAIN BEAM FOR VHF

Here are some details of a high-gain beam array for use in the VHF amateur bands. Usually referred to as the "3 over 3," this beam has found much popularity among the active VHF amateurs. It gives increased gain and lower angle of radiation over the more simple single-stack beam.

A SKETCH of this type of array appeared in the Australian Shortwave Handbook, 1950 edition. Unfortunately a drawing error resulted in an incorrect length being given to the phasing lines acting as quarter-wave transformers between each array and the common feed point. The correct lengths are shown on the sketch on this page.

Although there is a little more effort entailed in stacking beams in this fashion the advantages gained are swinging more and more VHF amateurs in favor of it.

LOW ANGLES

On the 50 mc band it is not difficult to run the full amateur limit of 100 watts input to the final stage, as suitable valves are readily available. The ubiquitous 807 is an excellent example. However, the important point is that, under normal conditions, the reception of signals is by medium of the ground wave only. This means that for best overall performance as much energy as possible should be radiated at low angles.

The vertical polar diagram or radiation pattern of a single stack of driven and parasitic elements is still influenced to a great extent by the height above the reflecting surface. In general, most suitable heights are between three-quarters and one wavelength, or over 2½ wavelengths.

Due to a number of factors the actual reflecting surface around the average "amateur" location is difficult to define and some benefit may result from experiment with array height.

A reduction of the radiated energy at the useless high angles and an increase of energy in the main lower lobe can be obtained by stacking parasitic beams—hence the "three over three."

THE "3 OVER 3"

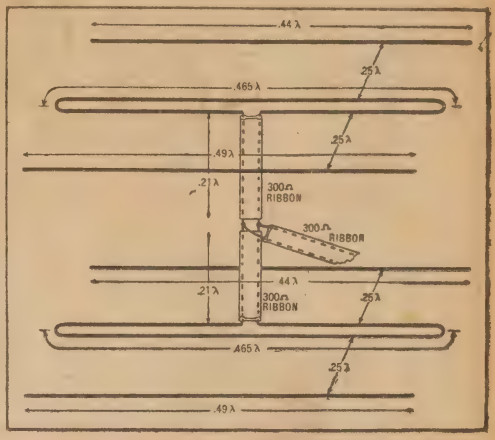
The stacked array shown in the sketch consists of two quarter-wave spaced three-element beams spaced 0.42 wavelength apart. This apparently odd spacing is dictated by the simple method of matching and phasing of the composite affair.

The driven element of each beam is folded with equal diameter conductors to give a multiplication factor of four and connected to the common feed point through an electrical quarter-wavelength of 300 ohm ribbon. With this arrangement the standing wave ratio on the main 300 ohm transmission line should be well under two to one, assuming negligible reactive loading on the line.

The materials on hand will doubtless govern the mechanical make-up of the whole system.

☆

The length of each quarter-wave transformer is corrected to allow for the reduction of the velocity of propagation along this material. This correction is 17 per cent, making each transformer 0.21 of a free-space wavelength.



Incidentally, the system can be fed at the lower beam instead of at the centre. The interconnecting line will then act simply as a half-wave phasing line providing that the connections to one beam are transposed. The combination of impedances will call for a low impedance feed such as 52 ohm or the 72 to 75 ohm type of cable.

The use of either type of cable will result in a standing wave ratio of much less than two to one. If coaxial cable is used it is definitely worth while to couple it via a balancing transformer at the point of feed. Any type other than the "trombone" will be suitable.

Irrespective of the manner of feed, the actual length of the elements will depend upon the length-to-diameter ratio of the rod or tubing used apart from one or two other variables. However, a good average figure for the driven and the parasitic elements is as given in the sketch. Remember that the length of the folded dipole includes the spacing between the two conductors, half of this spacing being effectively added at each end.

Incidentally, this spacing between the two conductors is not critical, provided that it is a negligible proportion of a wavelength. Being of equal diameters, a spacing of two or three times the diameter of one of the conductors should be satisfactory.

If the little extra gain obtained with five-eighths wavelength vertical spacing is desired there is a simple method of feeding the system. The phasing lines between the two beams are made up with coaxial cable of any available impedance. Simply cut two lengths 66 per cent of a wavelength long, connect the braids together at each end and use as a shielded two-wire line.

by Raymond Howe

INNER CONDUCTORS

The inner conductors are attached to the feed point of each beam and the braid bonded to the centre of the continuous conductor in each folded element. Allow a few extra inches to give enough length to the inner conductors to make the necessary connections. With this arrangement radiation and pick-up on the vertical phasing lines is virtually eliminated.

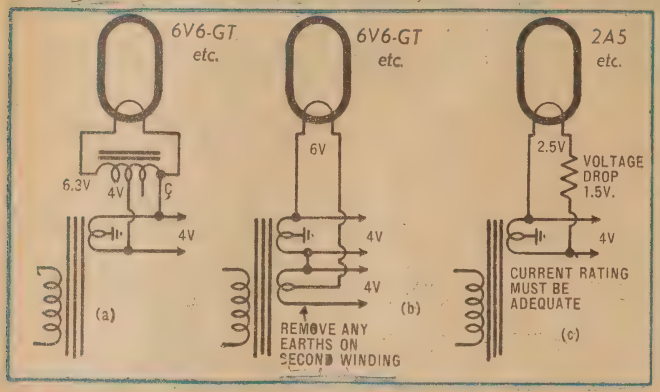
While the length of shielded line is electrically one wavelength long, its physical length is just right to allow the beams to be separated vertically by five-eights wavelength. The connections between the beams should not be transposed in this case.

The resulting impedance at the feed point of the lower beam will now be practically the same as in the previously-mentioned case when feeding at the lower beam and the same type of main feed line will apply.

FROM THE SERVICEMAN WHO TELLS

My contribution this month is very largely the story of one set, which I had the doubtful pleasure of fixing since I last put pen to paper. Apart from just about qualifying for the worst job ever, the individual faults were all typical of those which occur in the not-too-new receivers.

SPEAKING of old receivers, I don't know whether I've ever related the story of a visit some years ago to a country town. It was officially a weekend away, but a literally old friend-of-a-friend begged me please to have a look at an old radio which hadn't gone for years. Surely I could coax something from it without too much trouble?



A little intelligence will show how valves and filament voltage may be tailored to accomodate various types.

The said radio was one of the very first all-electric sets, with a couple of 26's, a 27 and a 71A. The tuning condenser and the remaining controls were attached by lengths of decrepit hookup wire, the old horn speaker was apparently burned out, and every terminal was either loose or stripped or stuck—including those on the rather dubious audio transformer.

I duly explained to the owner that I would have to work the rest of the weekend to fix all the things I could see wrong, let alone getting it going after that. Furthermore, I knew a fellow—and I did too—who was looking for a cabinet of the general type to rebuild into something else.

OLD SETS

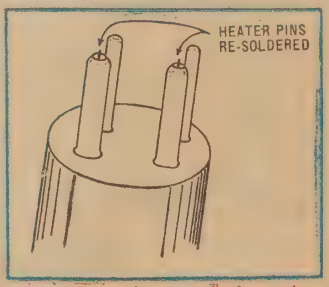
To cut a long story short, I bought the thing for ten bob, gave the works to a local lad and delivered the woodwork only to the budding cabinet maker.

I then managed to sell the original owner a new mantel set, and everyone was happy.

There comes a day in the life of every set, when it just isn't worth fixing any more.

The one I started out to tell you about had originally been built around a line of European tubes which have long since disappeared from the local scene. Largely through lack of suitable replacements, the set had been idle for years before it eventually came my way.

As it was, one of those inevitable household reorganisations caused the owner to ask whether the set could not be put into some sort of order. He didn't mind spending a few pounds on it, but certainly did not want to lay out enough to buy a new set.



Re-soldering valve pins will often make old valves like new where bad contact exists with element leads.

Someone had looked at the thing a couple of years ago, but it was going to cost more than they were prepared to pay just then. It hadn't been touched since.

It was obviously an ordinary 4/5 dual-wave superhet and, apart from the possible difficulty of obtaining valve replacements, there seemed to be no reason why it could not be made to work as well as the next one. Okay, I would see what could be done, and, of course, I understood that the cost must not run into anything out of proportion to the circumstances.

Back on the bench, the first obvious point was that the previous serviceman had apparently started the job and been stopped in his tracks, for all the wires had been lifted away from a faulty voltage divider and left in mid-air. Having just taken them off, he would have had no trouble in replacing the component, but Muggins had to trace out every one of those wires to the two ends, and three tappings to make sure where they all went to and came from.

For pity's sake, never leave a job like that, half-way.

A bit more checking and tracing and I was then game to switch the set on. However, it may as well have been left off for all the sound it made, either from fiddling with the aerial terminal or the "hot" pickup terminal. The audio end was obviously dead, and I therefore had not the faintest idea whether the tuner was working or not.

FIRST CHECKS

Admittedly, a signal tracer would have helped me here, but "old faithful" was itself in need of attention. Rather than take time off to fix it, I adopted other measures.

As it was, I could only run the voltmeter over the first two sockets and note that the valves were apparently generating two or three volts of self-bias, indicating that they were drawing a respectable amount of current. The oscillator grid resistor was then located and a meter connected in series with the cathode return end. A reading here of about 0.2 ma., which varied with the tuning, indicated that the converter was apparently working. So far, so good!

The diode-amplifier tube was apparently okay, also, but, since the output valve was back-biased, I had to open the plate circuit to get a current reading. Yes, sir, the output tube was drawing just 0.5 milliamp, which isn't much in any man's language. Here was one certain replacement.

Just about then, the HT voltage disappeared also, and I found the rectifier black out. Fortunately, an 80 plugged into the same socket allowed me to carry on. But was the tuner really working? Only the very faintest of sounds could be heard from the speaker, thanks to the dud output tube.

To settle the question, the output tube was removed altogether and a pair of earphone tips inserted, one in the grid position of the socket, and one in the earth terminal. Ha, a station — several stations — but mighty weak, if I could be any judge.

Next step was to check the trimmers roughly. Two of the IF trimmers peaked okay, but the others were as flat as the nose on my face. Sorry, I have the wrong simile.

A subsequent check with the ohmmeter and the set switched off indicated only a few ohms for the IF secondary windings, but a rather uncertain 200-odd ohms for the primaries. Either the designer had gone mad in the first place or those primaries were just hanging on by the last strand.

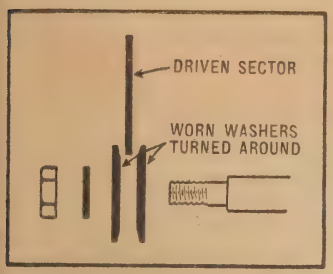
As far as I could see, therefore, the score looked like one voltage divider, one rectifier, one output valve and two IF transformers. In addition, there was the job of finding a replacement for the output valve, at least.

VALVE REPLACEMENT

There seemed to be no hope of getting even an approximate replacement for the old 4.0 volt output tube and the usual procedure, these days, is to instal an auto-transformer to step the 4.0 volts from the filament winding up to 6.3 volts, then change the socket and instal a 6V6-GT, or such like.

In some cases, the transformer may have two 4.0 volt windings as well as the one for the rectifier, and it is possible to connect them in series and pick off 6.0 volts at the centre tap of one of them.

In this case, I hesitated to spend the necessary on an auto-transformer, and luck was not my way in the second respect.



Old friction dial drives can be repaired by reversing the driving washers.

Since the other tubes were apparently okay, I decided on the easy way out, and selected a 2A5 as the replacement. A search through the resistor box brought to light a husky looking 1.0 ohm resistor which would obviously drop the voltage by just under 1.75 volts, leaving a little more than 2.25 volts for the heater — near enough!

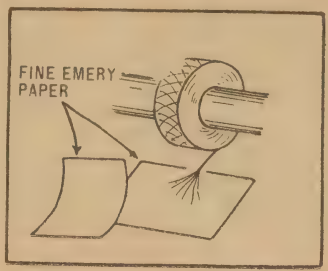
The new socket and the resistor were duly installed, and this time the audio end made rude noises when the pickup terminal was touched. But what about the rectifier?

The way it had failed earlier indicated that there might have been a faultily soldered joint inside a heater-pin, and this was indeed the case. I heated the larger pins with the iron and flicked away the solder cap, revealing the wire strands looking anything but well tinned.

By dint of a bit of poking and pulling, using the workshop tweezers, I managed to clean the tip of the wire and apply new solder and flux. This time the rectifier worked.

If luck had not been with me, it would have been necessary to use an 80 as a replacement. A 4.0 volt heater supply is well below the recommended minimum of 4.5, but the 80 will generally do well enough under these conditions.

So far, so good. But what about the IF transformers? Two new ones,



Repairing litz wire requires the cleaning up of all strands when soldering.

plus installation time, would push up the bill quite a bit. While there was no intention to run the business as a benevolent institution, I did not want to make the final charge look too steep.

Knowing that the procedure was quite legitimate in this case, I first checked through the serviceman's equivalent of the "junk box"—the place where you put out-of-date stock or other items which can't be classed as new but too good or too handy to throw away.

Tucked away therein was a pair of litz-wound transformers, rather out-of-date, but generally similar to those in the set. They checked okay and it seemed logical to use them and "split the difference" with the client. So to work.

CORRODED LITZ

Externally, every strand of the original windings appeared to be anchored at the terminal lugs and it was apparent that a green spot had developed somewhere inside each of the primary windings, rendering them almost open-circuited. Maybe something had got on to the spool of wire from which the primaries had originally been wound.

However, the net effect was very obvious. The d-c resistance of the primaries was many times that of the secondaries and the resulting "Q" of the windings so poor that they would not peak properly, even had they continued to work without breaking down.

Incidentally, if you ever have need to make a new connection to the ends of a litz-wound coil, make very sure that all strands are soldered. The approved technique is to fan out the strands on a layer of very fine emery cloth and then rub them outwards and roll them slightly with another piece of fine emery. Wind the strands around the lug and submerge them in a pool of hot solder. However, I'm getting well away from the story.

The new transformers were duly inspected and installed. This done, the set began to play in fine style, and a spot of alignment brought the signals up to pretty fair strength.

The stations were removed, however, from their proper places on the dial, and my guess was that the new transformers, peaking at 455 Kc, were well away from the original frequency, whatever it was. I found that the padder and trimmers had to be adjusted and readjusted in several operations before the signals could be tracked with the dial. The job was not made any easier by the fact that the dial was slipping rather badly in the meantime.

To correct this condition, I later removed the dial and inspected the movement. The dial employed a large, thin sector running between two washers, and these had worn sufficiently to lose their grip. To correct the condition, the washers were simply turned around to make use of the unworn sides.

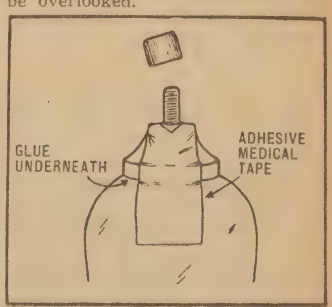
A spot of oil freed up the movement generally, while similar treatment of the gang bearings, the spindle of the dual-wave switch and the volume control shaft removed sundry squeaks and grating noises.

LAMINATION HUM

A few other details had to be cleaned up in passing. A lamination hum from the transformer was cleaned up by tightening the holding-down bolts. Yes, I was careful to hold the nuts underneath and thus avoided twisting off an earth lead.

One of the valves had a loose terminal-type top-cap which threatened to fall off any time, with disastrous results. This was carefully coated underneath with glue, then strapped down with a length of adhesive medical tape.

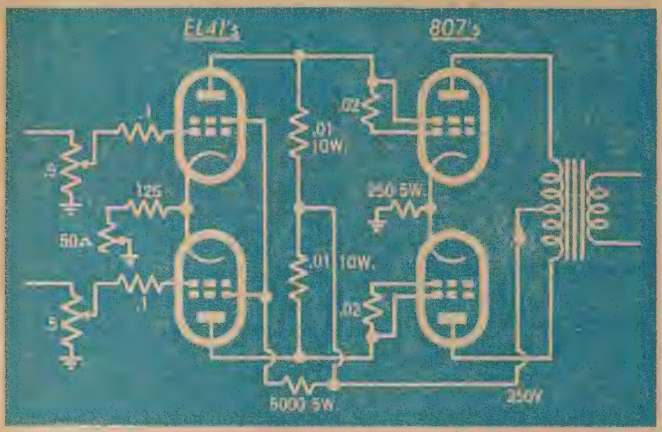
The converter valve produced slight crackles when tapped, but appeared otherwise to be quite normal. Apart from the fact that there was no replacement available for it, the owner was not likely to tap the valve just for fun, so that could be overlooked.



Adhesive tape and glue can often save an old hard-to-get valve.

Ultimately, it was returned and demonstrated, with the caution that I had fixed all the weaknesses I could detect, but that others might possibly show up after a period of resumed operation. The bill was unavoidably rather steep, but the owner was delighted at not having to purchase a new set altogether.

It was a long, messy job, but there is no doubt in my mind that yours truly will get all future business from that man and his friends.



Following up the zero-biased 807 triode idea, Mr. Yeoman, of Christchurch, New Zealand, developed this direct coupled amplifier. It uses high gain power pentodes to drive a pair of 807's. Push-pull input is required.

Let's Buy An Argument

We were all set, this month, to open up a new line of discussion through these columns. However, as things worked out, so many readers have taken up matters already raised that we simply cannot ignore their letters. The current bone of contention has to do with the effect of recording on phase relationships and complex waveforms.

by W. N. Williams

IT began, you may remember, with a reference by the Editor in his record columns to the difficulties of recording and reproducing extremely complex waveforms, of which the ultimate example was the familiar square wave.

The matter was taken up by Mr. Lambkin, of Arncliffe, NSW, in a letter which was summarised on page 102 of the December issue.

SOME IDEAS

As our comment disclosed, we did not agree with all the points he raised, but, by further summary and compromise, certain inferences can be drawn.

1. A cutter can produce something approaching a square wave track, because the stylus will maintain its lateral displacement while ever the driving voltage maintains a steady potential across the cutter terminals.

2. A pickup cannot reproduce a square wave. In the first place, its stylus cannot be accelerated by a wave front which is virtually at right angles to the direction of the groove. Secondly, it produces output only while the stylus is in motion. The tops of a square wave leave the stylus at rest and the mere displacement cannot produce a sustained output across the pickup terminals. The output would tend rather toward a series of "spikes" characteristic of a differentiating circuit.

3. The electrical output wave from a magnetic pickup is not an exact phase replica of the wave transcribed on the disc surface. A sine wave peak on the disc surface is the point of zero electrical output, the stylus being momentarily at rest. Conversely, the point of zero displacement on the disc is the point of peak electrical output, since the stylus velocity is maximum at this moment.

We chatted these matters over with a couple of engineers and found their immediate reactions to be diametrically opposed. The first, an expert on the subject of recording, agreed that there would appear to be a difference between the behavior of a cutter and a pickup with square wave input, but proceeded to point out that square waves are never encountered, anyway, in ordinary programme recording.

True enough, but fundamental tendencies and discrepancies can still have an important bearing on the behavior with a complex but less "mathematical" input signal.

IMPOSSIBLE SITUATION

The second engineer pointed out the physical impossibility of the square-wave-on-disc situation, but suggested that, for purposes of discussion, the record stylus could be considered as being connected directly to the pickup stylus, thus eliminating the doubtful recording medium.

This done, we would have an electro-mechanical link in the system, and it seemed unlikely to him that the output should differ fundamentally from the input, assuming good design throughout.

He further felt that any "theory" (in the exploratory sense) which claimed such a discrepancy must have overlooked some important factor.

As for the matter of phase displacement, he suggested that it would be substantially cancelled or corrected if both cutter and pickup were restricted to either voltage or current-operated devices—not a mixture of the two. Magnetic units give an "input" which is predominantly proportioned to current, whereas crystal and electrostatic devices are predominantly responsive to voltages.

When one adds to all this considerations of phase lead and phase lag within the coils or crystal elements themselves, and remembers that valve grids amplify voltage only one can be readily excused for asking: "Where the heck am I?"

It's quite refreshing to find that the system works after all and, what's more, you can even recognise the tunes!

But why spoil the mystery so early in the piece? Let's see what some of our readers have had to say.

A New Zealand reader, Mr. D. M. Yeoman, can serve as spokesman for one group of readers. He says:

"Crystal pickups must give a different wave shape from magnetic types . . .

"The voltage output is proportional

Do pickups behave like this ☞

to the stress on the crystal. This is greatest at the crest of the wave in the groove so that the voltage is in phase with the wave in the groove.

"With a magnetic type, the voltage is proportional to the velocity of stylus movement. . .

"Considering a wave with many harmonics, the magnetic pickup produces a totally different shape from the crystal and this may account for some of the distortion in a crystal pickup.

"I maintain that if the master is cut with a magnetic cutter, it should be played with a magnetic pickup. Similarly a master cut with a crystal cutter should be reproduced with a crystal pickup."

ANOTHER LETTER

From nearer home, Mr. H. B. Strantzen writes in support of Mr. Lambkin's letter and says that while our remarks are substantially correct for crystal devices, which are amplitude/voltage conscious, they would not hold for moving iron or moving coil devices. We quote:

"The enclosed curves help to make the theory clear. In A1 we have a triangular wave impressed on the record groove. A2 represents the resulting output voltage when the record is played with a moving iron or a moving coil pickup. A3 is a plot of the amplitude of a moving coil speaker diaphragm against time, when fed with a square wave input. If I had plotted velocity of displacement of voice coil I should show a square wave identical with the input. A4 represents the resultant waveform of the sound in air.

"The B series of curves are identical with the A series, but represent a more practical case showing the effect of rounding the triangular wave.

"C1 is the original triangular track on the record groove. C2 is the output voltage when played with a crystal pickup in which the output voltage is proportional to the amplitude of displacement and is a triangular wave identical with the track on the record groove.

"C3 is supposed to represent the amplitude of displacement of a moving coil when fed with a triangular wave input and is intended as a constant acceleration curve. C4 is the sound output wave in air.

"However, if we had fed C2 into a crystal speaker we would get a cone displacement like A3 and hence a square wave sound in the air.

"To sum up, it would seem that we should use either constant velocity devices throughout or (2) constant amplitude cutter and pickup in conjunction with a moving coil speaker or (3) constant velocity cutter in conjunction with constant amplitude pickup and speaker.

Also from Mr. Yeoman comes this series of sketches.

Well now, we're getting into pretty deep water and subject matter which I don't remember ever having seen discussed in print. At this stage it isn't very clear whether we are busy chasing red herrings or something important. Let's see.

THE CUTTER

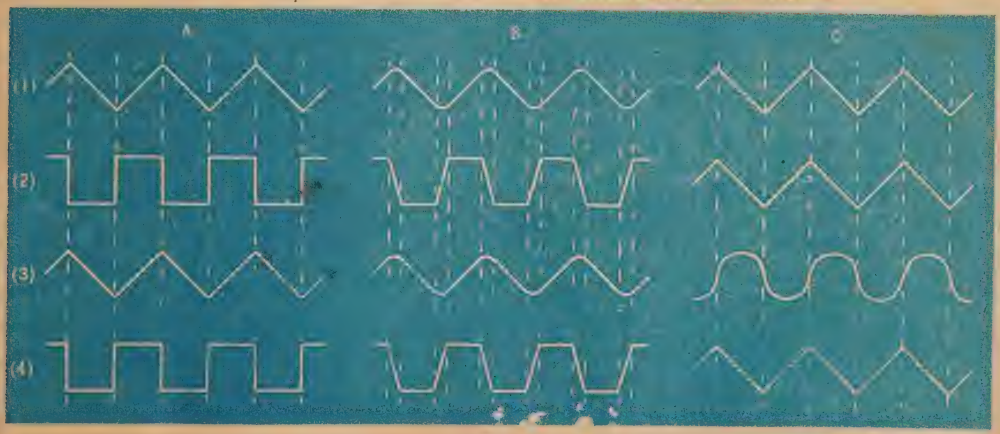
Focal point for the discussion is the exact behavior of the usual magnetic cutter, when fed with the hypothetical square wave input. Everyone, it seems, has fallen into the same trap of regarding the cutter as too simple a device, and when the various complexities are taken into account, everyone is partly right and likewise partly wrong.

Can a cutter produce a square wave track or not? I suggest that the answer will depend almost entirely on the frequency of the square wave input, the frequency response of the cutter and the rather vague relationship between signal input and stylus damping. With a low input frequency, I suggest that something like this could happen!

A voltage is suddenly applied across the terminals of the cutter, representing half of a square wave input cycle. Immediately the stylus is accelerated in one direction and the rate of acceleration &c., is limited by the mechanical mass and the stiffness of the assembly. However, if one assumes a unit with a good high frequency response and therfore a short "rise time," the stylus may well have moved an appreciable distance during the initial period of the square-wave half-cycle.

But the stylus cannot go on accelarating or moving during the whole duration of the half-cycle, because its movement is restrained by the damping medium. It must ultimately reach a state of equilibrium where the input power, represented by the

or like this—or how?



Mr. Strantzen traces the wave patterns right through to the loudspeaker.

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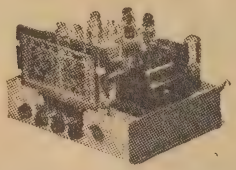

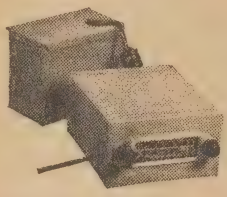

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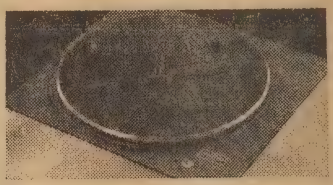

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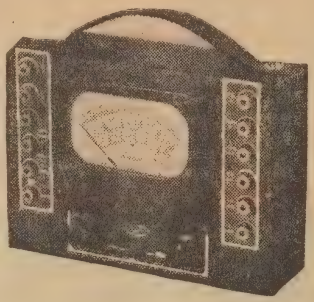

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KIT SET SPECIALISTS

"flat top," is absorbed in maintaining the compression of the damping medium.

The condition can readily be observed by manually switching a voltage across a cutter and observing the abrupt and defined deflection with different applied voltages. In fact, there is an immediate parallel with an ordinary moving iron or moving coil meter.

The answer to this may simply be that the suggested state of equilibrium would represent an overload of the cutter. That, with the normally applied 6db./octave bass cut, the the accelerating voltages at low frequencies would be reduced and the cutter deflection made less abrupt.

HIGHER FREQUENCIES

With higher input frequencies, the position will change in any case.

Inevitably the condition will arise when the stylus just reaches maximum deflection when it is time to go home again—the result, something like a triangular wave.

Go higher still and the waveshape will begin to look more and more like a sine wave as the harmonics pass geyond the region where they can effect the mechanical movement of the cutter. But this is a normal frequency limitation which is true of any circuit or device.

Quite frankly, I don't know the exact quantitative answer to all this nor, I imagine, do very many other people in the everyday strata of engineers and enthusiasts. It would be marvellous material for a special research paper in the journal of This-And-That Society.

The important thing, of course, is what it all means in practice and whether, after all, the exact waveshape is significant. I've already put my neck out on this question by suggesting that phase in a musical note is an unimportant quantity, being, in fact, purely random in its origin.

Generated electrically, a complex waveform can be regarded as a combination of a fundamental note plus a variety of harmonics. We become aware of the exact shape of a wave only by looking at it on a CRO screen.

THE EYES HAVE IT

The point of the matter is that the CRO and the eye can appreciate only the resultant waveshape, which depends on the relative voltage phase of the harmonics at the point of measurement.

The ear, however, is not concerned with arithmetic and tends rather to hear the individual tones. According to the weight of opinion, the exact phase of the harmonics has no auditory significance unless, of course, some overloading or non-linearity is present.

Concede this point and you can wipe off a lot of the discussion about phase angle, envelope pattern and so on. The crux of the matter lies not in the arithmetic shape of the wave envelope, but in the accuracy with which the frequency components are lifted from the groove. We get back on to familiar ground.

Just to round things off it is well to remember that complex waves of the type we generate electrically don't always occur in everyday sound, at least not with the same regularity and precision.

The precise phase relationship between harmonics and fundamental are largely an "accident" of microphone placement in the first instance.

SOMETHING ELSE!

But even assuming that some decision on this point could be reached, there is no guarantee that the wave envelope from a single instrument is going to remain constant, let alone from an instrumental combination.

Quite apart from tuning problems, the harmonics from an instrument are not necessarily an exact multiple of its own fundamental, so that phase relationships between individual fundamentals and their numerous harmonics are continually varying in a periodic fashion, picking up or losing complete cycles as they go!

Perhaps we had better leave the matter there for the time being.

Our anonymous friend "W.N." takes off on a completely different line of thought which, by coincidence, runs parallel to some remarks by the Editor in his record columns.

Before I attempt to explain the observations, let me hasten to assure our correspondent that there is indeed such a thing as "violin tone."

I happened to be walking through a Sydney arcade only yesterday when I heard the unaccustomed sound of a violin-piano combination. I knew instantly that it wasn't radio and it wasn't an ordinary recording either. But who would be playing tape in that busy spot through the best speaker I had ever heard?

THE REAL THING

In fact, it didn't sound like a speaker at all—it was too real. A moment later I spied the players and instruments up on a balcony.

Now at this juncture I'm not trying to be technical at all but merely to point out that the difference between the real thing and the normal recorded version was enough to quicken my interest above the noise of a busy street.

Without knowing our friend it may well be that he has not been blessed (or otherwise) with hearing capable of responding to the upper frequencies. Heredity, advancing years, sickness, &c., can all affect the acuteness of hearing in the treble register. I know several folk who can hear programmes as easily as I can but remain blissfully unaware of heterodynes around the 9 or 10 kc mark.

My own ears pass out like a light at 15½ kc. Other members of our staff show top limits varying between 9 kc and 19 kc—the highest figure I have come across. Perhaps the explanation is along these lines.

The only other thing I can suggest is that the auditorium was very heavily damped, as is the case with many picture theatres. They are excellent for their particular role but soak up the extreme highs like nobody's business.

MISSING TREBLE (or Whodunnit!)

Dear Sir,

Should the sound from my speaker be similar to what I hear in a concert hall?

I recently attended a free orchestral concert, and selected my seat with forethought. I aimed for a position whose distance from the orchestra made the difference in distance between me and the individual players unimportant, but so that I could hear clearly the direct sound from the instruments. I waited to be enthralled by genuine violin tone. Alas! Woe! Guess what? No highs!

Apparently "some of the high order harmonics and transients had been lost in transit," vide Radio and Hobbies, December, P67.

The ABC engineers in their infinite wisdom had placed their microphone over the front seats of the stalls, where it could best hear those harsh screeching overtones, which the players tried desperately to eliminate from their tone and which the listeners by their choice of position in the hall equally enthusiastically tried to avoid and ignore.

The only member of the audience who sat as close to the players as the microphone, was an elderly gentleman wearing a hearing aid and an expression of desperate tolerance. He abandoned his tolerance and his seat early in the programme.

I suspect that few in the audience wished to hear the orchestra as the microphone heard it.

Now just what did the engineers want? If they wished their listeners to hear the orchestra at its best, wouldn't they determine the best and therefore the most desired seat in the hall and hang their microphone over that seat?

I've heard about reverberation and the racket from the audience. Does the concert goer take any less notice of these than the radio listeners? If these noises are more obvious over the microphone, then maybe this fidelity is overdone. In any case, fidelity to what? I'm sure that no one in his senses wishes to hear directly either an orchestra or a brass band from the microphone position.
W. N. (Wayville).

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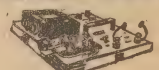

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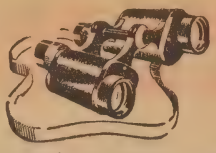

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FREQUENCY STANDARDS FOR UHF

Not many readers will have had occasion yet to measure frequencies in the U.H.F. region. The day may come, however, and it is interesting to review the methods which are being evolved to take over where the traditional grid-dip oscillators and absorption wavemeters leave off.

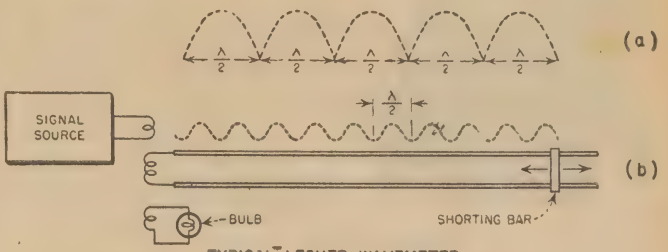
ACCURATE determination of the frequency of any cyclic phenomenon becomes increasingly difficult as that frequency departs further from the basic standard periodicity; the period of the earth's rotation.

For this reason, the measurement of radio frequencies in the ultra high frequency range (300-3000 mc.) necessitates the use of essentially new techniques — just as the original generation and transmission of such frequencies require methods which depart markedly from the conventional.

Because of the increasing interest in this portion of the radio frequency spectrum, in connection with UHF television, citizens radio, radar, microwave radio relay, and amateur communication, a review of these techniques is well justified.

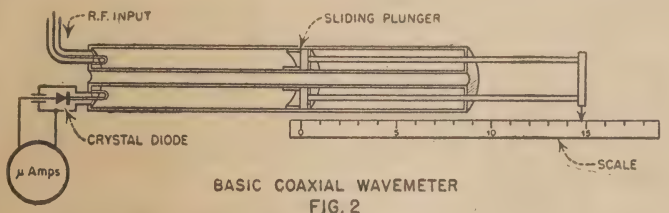
PRIMARY STANDARDS

At UHF, the usual primary standards employed at low frequencies are not conveniently applied. Signal frequencies derived from temperature-controlled crystal oscillators require an inconvenient number of multiplying stages to provide output in the UHF region and the harmonic content of primary standards employing low frequency multivibrators is usually insufficient to provide identifiable check-points at such frequencies.



TYPICAL LECHER WAVEMETER

FIG. 1



BASIC COAXIAL WAVEMETER

FIG. 2

In addition, the propagation characteristics in this part of the radio spectrum do not make the use of standard-frequency broadcasting, such as WWV transmissions, practical.

Other methods, such as the derivation of microwave primary frequency standards from the spectral absorption lines of gases exist, but are, at present, quite complicated and generally beyond the means of the individual experimenter or small laboratory.

One method of referring a low-frequency primary standard signal to the UHF region utilises a succession of self-excited oscillators, each synchronised by the zero-beat method with the last useful harmonic of its neighbor. The lowest frequency oscillator in the series is synchronised with a primary standard such as the WWV transmission.

Zero-beat or null indicators, consisting of meters or electronic tuning-eyes, are employed with each oscillator stage to give a ready indication of synchronism.

Good stability is required of each oscillator in the chain if frequent readjustments are to be avoided. With sufficient care in operation, this system will yield UHF check-points accurate to at least one part in one million.

Another simple system for obtaining UHF check-points against a primary standard has been used. This method produces usable harmonics throughout the lower portion of the UHF spectrum and is capable of excellent accuracy.

A conventional crystal-controlled oscillator circuit operating at five megacycles is supplied with unfiltered dc plate voltage.

The harmonic content of the crystal oscillator output is greatly increased by the application of this pulsating dc, with the result that marker frequencies occurring every five mc can be detected on a receiver throughout the 420 mc. amateur band, the citizens' radio band, and the UHF television band. An antenna cut for the desired output frequency serves to accentuate the harmonic output in that region.

The five mc. crystal signal may be compared in a receiver with WWV transmissions on that frequency and may be zero-beat by variation of the crystal holder pressure, or by a small variable capacitance connected across the crystal.

Since this method produces harmonics spaced at intervals equal to the crystal oscillator frequency, a secondary frequency standard, such as will be described later, must be used to identify harmonics.

Of considerably greater utility and convenience for the everyday measurement of ultra high frequencies are the standards based upon high quality resonant circuits.

The UHF predecessor of this family of frequency standards is the simple, well-known Lecher wire wavemeter. This instrument, used since the pioneering days of radio, is capable of high accurate wavelength determination in the lower UHF range, when judiciously used.

LECHER WAVEMETER

For the purpose of comparison with the more modern systems to be discussed later, a brief description of the Lecher wavemeter will be included here.

The basic Lecher wire wavemeter is illustrated schematically in Fig 1. It consists of a mechanically rigid length of parallel-wire transmission line, electrically coupled to the source of unknown frequency.

Operation is based on the principle that velocity of wave propagation along such an air-insulated transmission line is essentially equal to the velocity of light, and hence the frequency of the source being measured is related to the lengths of the standing waves measured along its length by:—

$$f = \frac{30{,}000}{\lambda\ (\text{cm.})} \text{ megacycles}$$

Indication of the lengths of standing waves on a Lecher wire is usually accomplished by sliding a short-circuiting bar along the transmission line and noting the positions

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0-3	0-6 mA	0-15	50-2250-100,000 ohms.
0-15	0-30 mA	0-150	x 500-22,500-1 megohm.
0-150	0-150 mA	0-300	x 5000-225,000-10 megohms.
0-300	0-1.5 Amps	0-600	
0-600			x with external battery.

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MODEL 75A

RANGES 20,000 ohms per volt A.C.—D.C.

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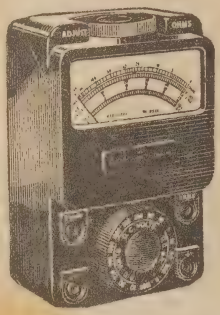
0—0.1	0—1	0—50 uA	—30 to —5	1—50—10,000 ohms
0—2.5	0—2.5	0—5 mA	—22 to +3	1000-50,000—10 Megohms
0—10	0—10	0—50 mA	—10 to +15	*10,000—500,000—100 Megohms
0—50	0—50	0—500 mA	+6 to +29	
0—250	0—250	0—5 Amps	+18 to +43	* With external battery.
0—1000	0—1000		+30 to +55	

This is a robust 20,000 ohms per volt 50 range universal multimeter designed for accuracy and stability. Fitted into an attractive case, the meter is provided with instantaneous OVERLOAD PROTECTION. The clear, easy to read scale has a length of 4 inches. An internal buzzer is provided for quick continuity tests. Complete with test leads.

PRICE £19/17/6 Plus Sales Tax.



MODEL 120A POCKET MULTIMETER

RANGES 1000 ohms per volt A.C.-D.C.

D.C. Volts	D.C. mA	A.C. Volts	Resistance
0—0.25	0—1	0—10	0.5—20—2000 ohms
0—10	0—10	0—50	50—2000—200,000 ohms
0—50	0—50	0—250	*500—20,000—2 Megohms
0—250	0—500	0—500	*5000—200,000—20 Megohms
0—500		0—1000	
0—1000		0—2500	* With external battery.
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This is an accurate pocket size instrument using a robust, sensitive meter movement fitted with instantaneous OVERLOAD PROTECTION and is housed in a high grade moulded case. All resistors used for voltage and current ranges are adjusted to an accuracy of 1%. Supplied complete with test leads.

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at which the line is resonant at the unknown frequency.

Resonance will occur at half-wavelength intervals, and may be detected by its interaction with the circuit being measured or by an r.f. indicator such as a flashlight bulb or thermo-milliameter coupled to the Lecher circuit.

The accuracy of the system depends upon the exactness with which the distance between points of resonance can be determined. Since these points correspond to r.f. voltage minima, they are usually quite sharp if losses are negligible. With considerable precision in construction and use, an accuracy of about .1 per cent can be achieved with a Lecher wavemeter.

At the higher frequencies of the UHF range, the accuracy of the simple Lecher wire system is limited by radiation losses, which lower the "Q" of the resonant circuit. This has the effect of introducing uncertainties in the positions of voltage minima, since these are no longer sharp as shown at (a) in Fig. 1, but are broader, as illustrated at (b) for a "lossy" line.

COAXIAL LECHERS

These shortcomings of the standard open Lecher line have been overcome by the use of the coaxial form of Lecher line shown in Fig. 2. Here the open, parallel-wire transmission line is replaced by a shielded coaxial line which is tuned by a sliding shorting plunger.

The unknown frequency is coupled to the coaxial wavemeter by means of an inductive coupling loop and concentric cable. Resonance is indicated by interaction with the circuit being measured, or by a suitable r.f. indicator coupled to the wavemeter by a second coupling loop. This indicator usually takes the form of a crystal detector and microammeter.

As in the basic Lecher system, wavelength is determined by measuring the distance between resonance points which occur each half wavelength. These points give maximum indications on the meter. Because of the fact that no radiation takes place from the coaxial circuit, very sharp resonances are obtained since the "Q" of the wavemeter can be made quite high, especially if the r.f. conducting surfaces are silver-plated and the coupling to the circuit is light.

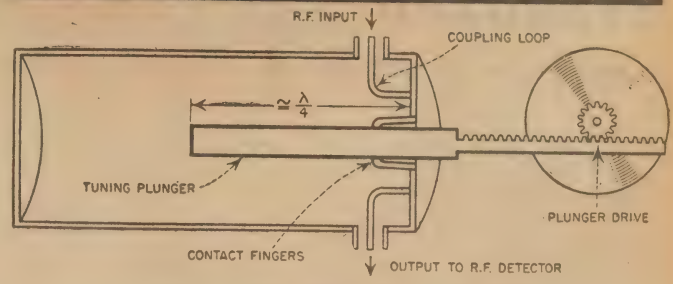
ACCURACY

The accuracy of the coaxial wavemeter is determined by the precision of the mechanical drive mechanism which measures the position of the shorting plunger. In a high quality instrument of this type, the distance between half-wave resonance points can be determined to within about .001 centimetre. At 3000 mc., this represents a realisable accuracy of .01 per cent.

Wavemeters of the coaxial variety are widely used as UHF standards since they are self-calibrating and are not greatly affected by temperature changes. The measuring accuracy of Lecher systems is increased if the line is long enough to permit the distance between several successive responses to be measured and averaged.

Another form of coaxial wavemeter, which makes a convenient secondary standard when calibrated by one of the foregoing systems, is depicted in Fig. 3.

This type is called a quarter wavelength coaxial wavemeter since it is resonant at the frequency for which the open-circuited centre conductor is an electrical quarter wavelength long.



QUARTER WAVELENGTH COAXIAL WAVEMETER
FIG. 3

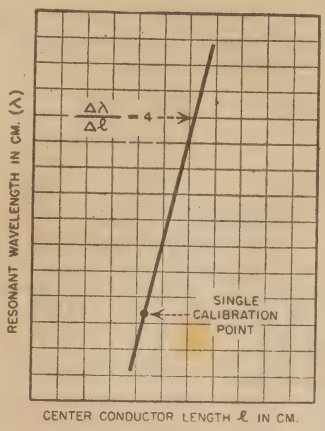
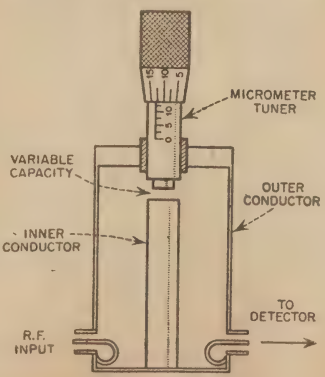


FIG. 4



CAPACITANCE TUNED COAXIAL WAVEMETER
FIG. 5

The centre conductor drive may be a rack-and-pinion arrangement for a "search" wavemeter in which extreme accuracy is secondary to wide tuning and convenience.

For greater precision over a smaller range, a micrometer head drive is usually provided for the centre conductor.

At the lower frequencies in the UHF range, wavemeters of the Lecher and quarter-wave coaxial types are somewhat bulky and inconvenient. For this reason, a capacity-tuned coaxial resonator as shown in Figure 5 is sometimes preferable.

This type is electrically similar to the quarter-wavelength variety of Figure 2, but is tuned by a variable capacitance at the end of the centre conductor, rather than by varying the centre conductor length.

The tuning characteristic of this type is not linear, so that it must be carefully calibrated against another

STANDARD -FERGUSON- RANGE

POWER & VIBRATOR TRANSFORMERS

	A.C.	Vib.			Retail
PF 122	240	6	220	40	6.3V @ 2A	33/6
PF 125	240	6	250	60	6.3V @ 2A	43/-
PF 119	240	6	325	125	6.3V @ 4A	62/-
PF 182	240	12	200	40	12.6V CT @ 1A	33/6
PF 126	240	12	250	60	12.6V CT @ 1A	47/6
PF 146	200,30,40	12	325	150	12.6V CT @ 2.5A	67/-

FILTER CHOKES

	Induct	D.C. Res.	M.A.		Retail
CF 100	50	1900	10		18/-
CF 101	30	870	25		18/-
CF 102	15	300	60		12/-
CF 103	30	420	60		26/-
CF 104	30	580	75		31/-
CF 105	15	250	80		24/-
CF 106	12	200	100		24/8
CF 107	30	360	100		34/8
CF 108	12	135	150		35/-
CF 109	20	225	150		37/8
CF 110	12	100	200		43/8
CF 111	16	165	200		45/10
CF 112	10	70	250		46/2

SPECIAL CHOKES

					Retail
CF 113	.5	70	250		
	20		50	Swinging choke	50/6
CF 114	1.1	23	375	Ballast choke	24/-
CF 115	.017	.6	2 amps	L.T. choke	10/-

OUTPUT TRANSFORMER TO VOICE COIL
Full Frequency Range (30-15000)

Code No.	Pri. Imped.	Sec. Imped.	Watts	Retail
OP24	5000 SE	8.4, 2.1, with feed back	5	44/10
OP23	3250 SE	12.5, 8.4, 2.1	10	65/1
OP19A	5000 PP	12.5, 8.4, 2.3	15	102/10
OP51	4500 PP	15.5, 12.5, 8.6, 2.7, 2	20	90/-
OP63	10000 PP	15, 3.75	15	100/-
OP64	10000 PP	12.5, 3.125	15	100/-
OP65	10000 PP	8.4, 2.1	15	100/-

OUTPUT TRANSFORMER TO VOICE COIL
Special Full Frequency (20-30,000)

					Retail
OP25/40	10000 PP	40, 10	15		130/-
OP25/16	10000 PP	16, 4	15		130/-
OP25/15	10000 PP	15, 3.75	15		130/-
OP25/12	10000 PP	12, 3	15		130/-
OP25/10	10000 PP	10, 2.5	15		130/-
OP25/8.4	10000 PP	8.4, 2.1	15		130/-
OP66	5000 PP	8.4, 3.7	15		130/-
OP67	5000 PP	15, 6.5	15		130/-

OUTPUT TRANSFORMER TO LINE—
Full Freq. Range.

					Retail
OP22	3250 SE	500, 125, 8.3	10		65/1
OP19b	5000 PP	500, 250, 125	15		102/10
OP21	8000 PP	500, 250, 125	15		82/10
OP62	10000 PP	500, 125	15		100/-

OUTPUT TRANSFORMER TO LINE—
Special Full Freq. Range

					Retail
OP25/500	10000 PP	500, 125	15		130/-
OP25/250	10000 PP	250, 62.5	15		130/-

VIBRATOR TRANSFORMERS

Code No.	Pri. V.	D.C. Out.	M.A.	Buffer Full Sec.		Retail
VT 100	32	200	40	.005	Sync.	27/-
VT 101	6	90	15	.008	"	19/6
VT 102	6	150	25	.005	"	23/10
VT 103	6	200	50	.005	"	25/-
VT 104	6	250	60	.005	"	37/-
VT 105	12	250	60	.005	"	37/-
VT 106	6	300	75	.008	"	52/-
VT 107	6	250	60	.005	Sync. Low Rad.	30/6
VT 108	12	90	15	.008	Sync.	21/8
VT 109	24	90	15	.008	"	23/8
VT 110	12	150	25	.005	"	23/10
VT 111	24	150	25	.005	"	26/6
VT 112	12	200	50	.005	"	25/-
VT 113	24	200	50	.005	"	26/6
VT 114	12	300	75	.008	"	54/2
VT 115	24	300	75	.008	"	55/6
VT 116	24	250	60	.005	"	30/-
VT 117	12	250	60	.005	Non Sync. Low Rad.	31/-
VT 119	32	150	25	.005	Sync.	25/6
VT 121	6	180	30	.005	"	25/4
VT 122	6	400	50	.005	"	50/-
VT 123	12	320	125	.005	Sync.	63/3
VT 124	32	250	60	.005	"	30/-
VT 127	6	200	50	.005	Sync. Low Rad.	29/8
VT 128	12	250	60	.005	Sync. Low Rad.	38/-

RECEIVER POWER TRANSFORMERS

Code No.	Prim.	HTV Aside	M.A.	Filaments	Retail
PF 185	240	150	30	6.3V @ 2A	24/-
PF 106	240	325	45	6.3V @ 2A, 5V @ 2A	30/-
PF 198	240	285	50	6.3V @ 2A, 5V @ 2A	30/-
PF 151	200,30,40	285	60	6.3V @ 2A, 5V @ 2A	34/-
PF 165	200,30,40	385	60	6.3V @ 2A, 5V @ 2A	34/-
PF 170	200,30,40	285	80	6.3V @ 2A, 6.3V @ 2A, 5V @ 2A	39/10
PF 168	200,30,40	385	80	6.3V @ 2A, 6.3V @ 2A, 5V @ 2A	39/10
PF 130	200,30,40	285	100	6.3CT @ 2A, 6.3V @ 2A, 5V @ 2A	46/-
PF 160	200,20,40	385	100	6.3CT @ 2.5A, 6.3V @ 2A, 5V @ 2A	46/-
PF 152	200,30,40	285	125	6.3CT @ 3A, 6.3V @ 2A, 5V @ 2A	56/-
PF 181	200,30,40	385	125	6.3CT @ 3A, 6.3V @ 3A, 5V @ 2A	66/-
PF 174	200,30,40	285	150	6.3CT @ 2A, 6.3V @ 2A, 5V @ 2A	60/-
PF 175	200,30,40	385	150	6.3CT @ 2A, 6.3V @ 2A, 5V @ 3A	70/-
PF 173	200,30,40	425	175	6.3CT @ 3A, 6.3V @ 2A, 5V @ 3A	110/-
PF 140	200,30,40	385	200	6.3CT @ 3A, 6.3V @ 3A, 5V @ 3A	111/-
PF 171	200,30,40	385	250	6.3CT @ 4A, 6.3 @ 3A, 5V @ 3A	144/-
PF 201	240	225	50	6.3 @ 2A	29/11

LINE TO VOICE COIL TRANSFORMERS

	Pri. Imped.	Sec. Imped.	Watts	Retail
MT111	500	12.5, 8, 2.3	10	36/9
MT100	600	4, 3	15	36/9
MT101	500	15	15	36/9
MT124	600, 500	4, 3, 2.7, 2.3, 2	25	66/-
MT125	600, 500	15, 12.5, 8.4, 6.5	25	66/-

MODULATION TRANSFORMERS

				Retail
MT118	8000, 6000 PP	10000, 7000 5000	25	85/-
MT119	8000, 6600, 3800 PP	10000, 7500, 6500 5500, 4500, 3500	50	111/-
MT120	500 to 20000 in steps.	500 to 30000 in steps.	50	200/-
MT121	500 to 20000 in steps.	500 to 30000 in steps.	125	276/-

Output Transformer To Voice Coil—P.A. Range

	Pri. Imped.	Sec. Imped.	Watts	Retail
OP1	5000, 2500 SE	12.5, 8, 2.3	10	39/10
OP54	5000, 2500 SE	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	10	45/8
OP39	5000, 2500 SE	15	10	39/10
OP33	5000, 2500 SE	5, 2.7	10	39/10
OP41	5500 SE	3.7	10	46/-
OP53	30000, 20000 14000, 10000, 7000 5000, 2500 PP	2.2	10	36/9
OP2	5000 PP	12.5, 8, 2.3	15	65/1
OP55	5000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	15	73/10
OP3	6600 PP	12.5, 8, 2.3	15	65/1
OP56	6600 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	15	73/10
OP4	10000 PP	12.5, 8, 2.3	15	65/1
OP57	10000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	15	73/10
OP5	10000, 6600, 5000 PP	12.5, 8, 2.3	15	65/1
OP58	10000, 6600, 5000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	15	76/2
OP59	10000, 6600, 5000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	25	93/8
OP60	10000, 6600, 5000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	32	116/8

OUTPUT TRANSFORMER TO LINE—P.A. Range

	Pri. Imped.	Sec. Imped.	Watts	Retail
OP1A	5000, 2500 SE	500	10	39/10
OP44	5000, 2500 SE	500, 250, 125	10	47/-
OP34	5000 PP	600, 300, 200, 150, 130, 100 75, 50	15	81/4
OP6	5000 PP	500, 250, 125	15	65/1
OP7	6600 PP	500, 250, 125	15	65/1
OP50	8000 PP	600, 300, 120, 60, 30	15	126/-
OP8	10000 PP	500, 250, 125	15	65/1
OP8M	10000 PP	500, 250, 160, 125, 100, 83.5 71.5, 62.5, 55.5, 50	15	71/3
OP9	10000, 6600, 5000 PP	500, 250, 125	15	65/1
OP10	5000 PP	500, 250, 125	25	81/10
OP11	6600 PP	500, 250, 125	25	81/10
OP38	6600 PP	600, 300, 250, 200, 170, 150, 76, 50, 36, 27, 12.5, 7.5, 3.6, 2.7	25	140/-
OP12	10000 PP	500, 250, 125	25	81/10
OP13	10000, 6600, 5000 PP	500, 250, 125	25	81/10
OP35	10000, 6600 PP	500, 4000, 8.4, 2.2	25	120/-
OP14	5000 PP	500, 250, 125.	32	102/10
OP48	6600 PP	140, 70.	32	117/8
OP15	6600 PP	500, 250, 125	32	102/10
OP15M	6600 PP	500, 250, 166, 125, 100 83.5, 71.5, 62.5, 55.5, 50	32	104/1
OP16	10000 PP	500, 250, 125	32	102/10
OP17	10000, 6600, 5000 PP	500, 250, 125	32	102/10
OP36	3800 PP	17.6	60	108/7
OP18	3800 PP	500, 250, 125	60	108/7
OP61	3800 PP	100, 75, 25, 10, 5, 2	60	133/8
OP37	6400 PP	500, 250, 125	80	150/8
OP49	8800, 6000 PP	500	105	210/-
OP20	11600, 8400 PP	500, 250, 125	150	276/-

ALL PRICES SUBJECT TO ALTERATION WITHOUT NOTICE

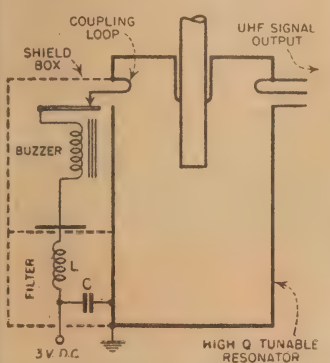
standard at a sufficient number of points to allow a curve of frequency (or wavelength) versus tuner setting to be plotted.

Although the "lumped" tuning capacity of this type of wave meter makes it somewhat more compact than the types previously described, it is considerably more susceptible to errors due to thermal expansion.

By careful design, this effect may be compensated in most wavemeters by the use of special low-expansion materials such as "Invar," or by making the outer conductor of a material having a temperature co-efficient sufficiently greater than that of the centre conductor that capacitance changes due to expansion are corrected.

An alternative design makes use of a small temperature — compensating fixed capacitor connected between the outer conductor and the end of the inner conductor.

Calibrated signal courses for experimental work with UHF receivers, antennas, and other components may be produced by utilising high quality resonant circuits of the type described above for the frequency determining elements of self-excited oscillators. In general, the accuracy and stability of such devices is much inferior to that of the same circuits used as wavemeters because of the loading and thermal instability introduced by the vacuum tube.



BUZZER SIGNAL GENERATOR
FIG. 6

An important exception is the buzzer signal generator shown in Figure 6. In this extremely simple and useful device, a high "Q" cavity wavemeter, usually of the quarter-wave length type, is excited by the noise "hash" generated by the interrupter contacts of a buzzer.

ACTS AS FILTER

The wavemeter circuit acts as a very selective band-pass filter which passes only the frequency component to which it is tuned. Since the short pulses generated by the buzzer are very rich in high frequency content, the signal generator will provide useful output throughout the entire tuning range of the resonant cavity circuit.

The output signal is tone modulated at the buzzer frequency. To prevent spurious radiation, the buzzer and its d-c leads must be well shielded and filtered.

The frequency stability and accuracy of the buzzer signal generator is essentially equal to that of the wavemeter circuit used, since no vacuum tube is used to contribute electronic loading and little heat is generated. Such devices have been used as standard signal sources to at least 10,000 mc.

References

1. Electronics, April, 1949.
2. Radio and Television News, January, 1950.
3. Electronics, March, 1948.
4. Electronics, September, 1949.
5. Electronics, July, 1950.

(By courtesy of the Aerovox Corporation).

Sound Waves Photographed

SOUND waves are photographed by a new technique developed by Bell Telephone Laboratories, USA. Equipment consists of a tiny microphone and a neon lamp mounted on a swinging beam that scans the wave field.

As the beam moves through the field, the pattern of sound radiation is built up by scanning.

Here's your answer, Tom!

If Tom's electronic ambitions were to be pursued to their bitter end, he and a lot of his pals would end up in "clink", their parents would find asylum in the homes for mental incurables and the vaults of the P.M.G. Dept. would be filled with confiscated transceivers. In other words, Tom has been bitten again with the transmitting bug.

WRITING from a little hamlet on the north coast of NSW, Tom requests in all innocence:

Would you please oblige me by describing a simple and easy-to-build transmitter which I can use to talk to my mate who lives about half a mile away?

It seems, Tom, that no matter how many times we issue advice, warnings, threats and such like, the same

question comes up for answer again and again. Perhaps we have to blame some of our overseas and not-so-technical contemporaries, which have fewer inhibitions about the restrictions on radio transmission.

But the chain of events would inevitably go something like this. We would publish a simple and inexpensive little transmitter. You would worry the life out of your parents until you managed to buy the necessary parts. Maybe you'd get by with a few substitute bits and pieces from an old set, and use the coils instead of the ones we'd specify.

Then you'd go on the air, and, with a bit of luck, your mate would hear you—but so would a lot of other people in the district. At first they might be amused and tolerant, but after that they would get so mad at the chatter, the whistles and the buzzes that someone would write in to the authorities.

Sooner or later, someone else would appear with a direction finding outfit and ultimately they would knock on your door. There would be a court case, a fine and a lot of nasty goings on, which would take all the fun out of radio for a long time to come.

And I'm not kidding, Tom, it's happened several times in the last few years.

There's only one way you can legally operate your own station, and that's to get your Amateur Operator's Certificate of Proficiency—better known as your "ham" ticket—and set up a station in a right and proper fashion.

Even then you can't use many of the simple low frequency transceiver circuits you see published. Most of them would wander all over the place and generally behave in such a fashion that they would invite the ire of your fellow "hams," if not the PMG boys.

In other countries, the authority on these matters will vary, but the official attitude will be the same.

What is meant by a "PM Speaker"? I often see reference to them in your advertisements.

The initials mean "permanent magnet" or "permagnetic," to use a hybrid term.

Nearly all speakers, these days, are dynamic types, and dynamic speakers require a concentrated magnetic field around the voice coil. In the early days, this was almost invariably provided by a large winding around the pole piece carrying a direct current from the main power supply, or from a small auxiliary supply. In other words, they had a "field" coil, which needed energising.

More recently, the trend has been to fit the speakers with large permanent magnets, which have now been made so good that they provide a more concentrated magnetic field than a field coil of the same general dimensions. In addition, it saves the bother of having to provide an adequate energising current from the receiver.

Well then, Tom, a "PM speaker" simply means a permanent magnet dynamic type, as opposed to a dynamic type requiring field energisation. Permagnetic speakers are essential in battery sets, but they are commonly used in a-c sets also.

If I were to buy a transformer which would give me 6.3 volts from the power mains, could this voltage be used to operate a 6-volt vibrator set?

No, Tom, definitely not! The d-c supply from the usual accumulator energises the magnetic field of the vibrator cartridge, causing the reed to vibrate back and forth at its fundamental frequency, which is about 100 c/s.

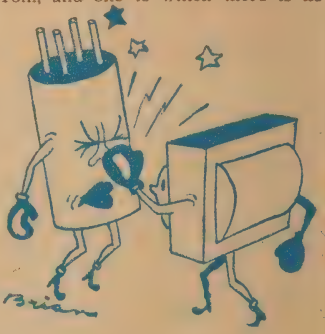
As the reed impinges against first one set of contacts and then the other, it sends pulses of direct current through the transformer primary, and, at the same time rectifies the pulses which are produced in the secondary and turns out the necessary high-tension voltage.

The whole operation of the cartridge relies on there being instantaneous and unidirectional pulse of current available from the primary driving battery. If this battery were replaced by a filament transformer, the 50-cycle alternation would get hopelessly mixed with the approximate 100-cycle operation of the reed, so that the poor thing would never know whether it was coming or going.

But even if the reed did manage to vibrate in some kind of step with the power mains, the voltage induced in the transformer secondary would be hopelessly confused.

Is it possible to buy a book which will teach me how to use a multimeter? My problem is to know whether the various readings are anywhere near what they should be.

Your problem is a common one, Tom, and one to which there is no



simple answer. We've said this before, but one of these days we'll have a go at cooking up an article which will at least be as helpful as we can make it.

But the point is that multimeter readings must be interpreted and this demands a knowledge of circuit practice.

Without launching into a long discourse. Tom, our advice is to learn

to use your multimeter first for straight resistance and continuity tests. Be careful to switch the set off first and disconnect it from the batteries or the power mains. Then, with the circuit alongside you, go through the wiring, measuring resistance from point to point.

Where two points are shown joined together on the circuit, there should be zero resistance between them as read on the meter. If a cathode has a 200-ohm resistor to earth, you should be able to read 200 ohms across the cathode circuit on your meter. There should, obviously, be an infinite or a very high resistance between the B-plus line and earth, otherwise a short-circuit is indicated.

Get the idea, Tom?

After that, you may switch the set on and very carefully check the voltage on the high-tension line. The order of the voltage on this line is usually obvious from the circuit or descriptive matter. You can check the voltage on the plates and screens, expecting it to be much lower than the high-tension line where series resistors are involved.

If you work along these lines slowly, Tom, you will gradually get used to the thing. Try to establish the reason for the various readings and develop in your mind the relationship between the circuit, the receiver under test, and the reading from the meter.

That's the only way we know of becoming proficient with a meter.

Some commercial set manufacturers mark on their circuits the voltages to be expected at various points when using a specific class of voltmeter. This is very handy, because it saves a certain amount of thinking, but the aim is to get past this stage and learn to interpret circuits and readings for yourself.

How does one calculate the diameter, number of turns, the gauge of wire and so on for tuning coils? If I knew the formula it would save me a lot of rewinding.

There are formulas covering all kinds of coils, Tom, but unfortunately, they are well removed from the A equals B plus C variety.

Fundamentally you must first work out the inductance of the coil you need and this depends on the tuning range you wish to cover, the capacitance figures of the tuning condenser and the total capacitances across the coil, due to the windings themselves, the wiring, the valve and so on.

That first operation of calculating the required inductance necessitates making a few intelligent guesses, then applying a not-too-complicated formula and making it come out in the units you want.

After that you have to make up your mind as to how big the coil is to be, how long and how wide. Knowing the length, width and required inductance you can work out approximately how many turns would have to be fitted on to the former space to give the required result. Lastly, wire tables would be needed to find out the gauge of wire which will conveniently allow the required number of turns to be wound into the available space.

When the coil is finished, even after all that, you may have to add or remove a turn or two to make up for approximations in the figuring.

It sounds messy, Tom, and it is messy. If you want to go through the whole procedure, you can find the necessary formula in books like the "Radio Designers Handbook."

Frankly, Tom, we've worked out plenty of coils in our time, but we've also used tables and charts a lot and arrived at the end result by trial and error. If you know that a short-wave coil wants about 10 turns, it's often a lot easier to wind on 12 for luck, then reduce it a turn at a time till it comes out right.

If you can find data by someone who has worked it out before, go to it and save yourself a lot of bother.

How do you calculate the output from a rectifier valve?

This is something which, fortunately, you don't have to calculate, Tom.

The idea is to arrange with one of the local valve companies to supply you with a book of valve applications data and curves, usually made up in loose-leaf form. In it you will find complete curves for the popular rectifiers. It is simply a matter of reading off the information you want from these.

Let's say you want to know how many volts you will get from a 5Y3 rectifier with 300 volts on the plates, a condenser input filter and a current drain of 100 milliamps.

You turn to the 5Y3 curves and pick out the one which is drawn for condenser input. You find a graph with a set of sloping lines drawn across it marked "RMS Input Volts Per Plate" 400, 385, 350, 300 and so on. You naturally pick on the 300 volt line because that is the one in which you happen to be interested.

The bottom line is marked "D.C. Load Milliamps," and you pick out the 100 milliamps line and follow it up to the point where it crosses the 300 volt input line. Following it across, you discover that it corresponds to just about 275 volts on the vertical "D.C. Output Volts" scale.

You may have to subtract the odd 25 volts for the drop across the filter choke, leaving about 250 volts for the high tension line. Simple, eh, Tom?

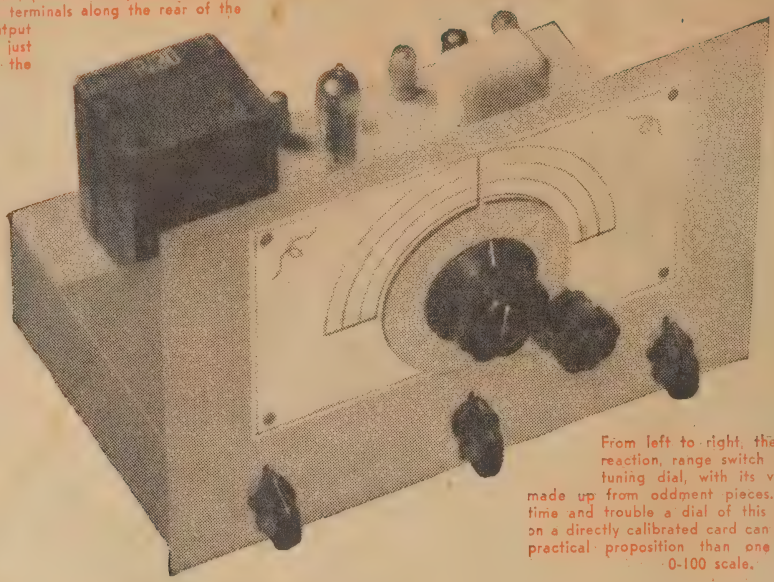
How do you decide whether valves or wiring need to be shielded?

Briefly, the purpose of shielding wires or valves is to prevent coupling with other circuits which, in a multi stage receiver or amplifier, may cause oscillation or the introduction of unwanted signals.

Most low level audio wiring requires shielding but radio frequency circuits are rarely wired with close-fitting shield wire because of the excessive attenuation which would result. Careful arrangement of the parts is necessary together with metal partitions between stages.

Most R.F. valves require shielding although some of the more modern types have shielding incorporated.

The use of small components gives the chassis a neat, open appearance and makes for easy wiring underneath. Aerial, phone and speaker connections are made to terminals along the rear of the chassis. The output transformer can just be seen above the panel.



From left to right, the controls are — reaction, range switch and volume. The tuning dial, with its vernier knob was made up from oddment pieces. With a little time and trouble a dial of this type, registering on a directly calibrated card can be a much more practical proposition than one with a simple 0-100 scale.

The Radio and Hobbies

THREE-BAND-THREE RECEIVER

With a home-made coil unit, the latest miniature valve types and a neat, business-like chassis, this little receiver is ideal for those who want shortwave reception without spending a fortune. It covers the entire broadcast band and two shortwave bands. Band spread is optional.

by Maurice Findlay

WITH thoughts of dual conversion superhets, crystal calibrating oscillators, &c., it is easy to forget how well a good regenerative receiver can be made to operate. We had quite a kick from building this little job and, after making the preliminary adjustments to the coil, were truly amazed at the ease with which overseas stations could be tuned.

We stress the point about a smoothly-operating regenerative receiver. There is a world of difference in performance between a smooth job and some of the cranky, squealing devices which come under the same heading.

To get the best out of a regenerative set, it is essential to be able to adjust the detector, so that it is always on the verge of oscillation, and it must slide smoothly into weak and steady oscillation for reception of unmodulated Morse code signals.

With only one tuned circuit to select the required signal, the aerial coupling must be carefully adjusted to give the best compromise between gain and selectivity, and with the aerial connected, the set must go into oscillation with the screen voltage close to optimum all over the band.

To fulfil all these conditions with bandswitching, it was necessary to work out a new set of coil data for small diameter formers, so that the coils could be mounted neatly around the switch. The final results were well worth the trouble. It is a real pleasure to switch easily and surely from band to band, without having loose coils lying around.

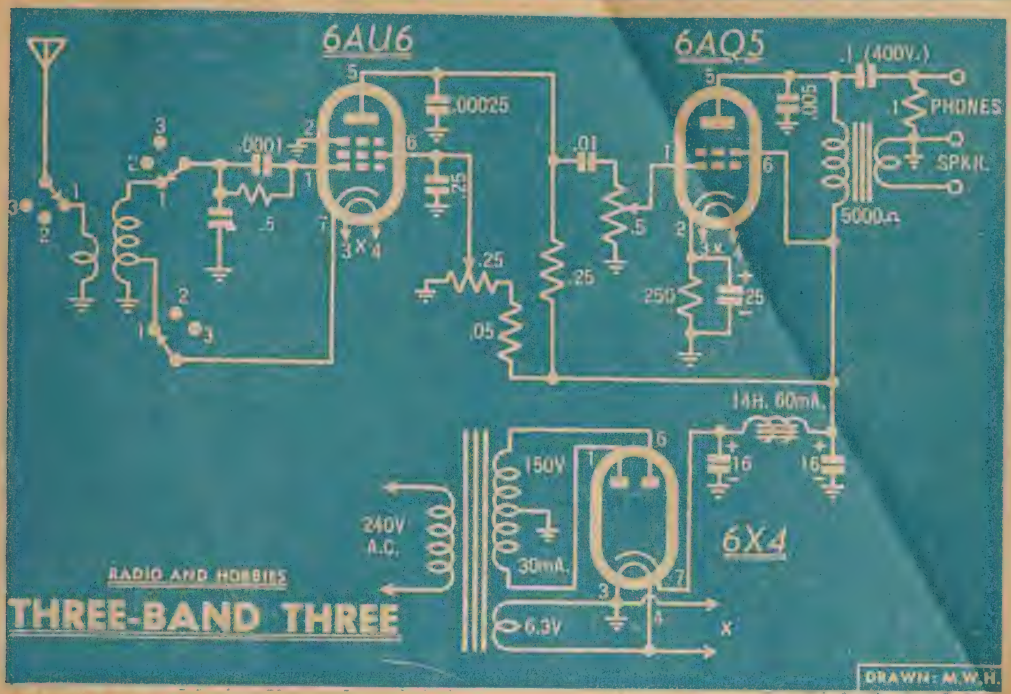
With the circuit and all the coil data carefully worked out for you, there is no reason why your version of the set should not perform just as well as the original.

BANDSPREADING

The method of obtaining bandspread for the shortwave bands is a subject worthy of discussion. In the past, a favorite method has been to wire a small variable condenser in parallel with the main tuning condenser. The idea is that you tune to the vicinity of the band with the larger condenser and then tune over the band in question with the smaller condenser.

This method has frequently been used in the past, but has certain disadvantages for a small set, the principal being that it does not lend itself to easy and accurate calibration. Two dials are required and the

RECEIVER COVERS BROADCAST AND SHORTWAVE



The circuit is an old reliable brought up to date with the latest components. It features a bandspread switch and gives one almost as performance for a modest outlay. Additions for bandspread are given on page 53.

setting of one directly affects the other.

With the usual 400 mmfd. tuning condenser the frequency range covered is in the vicinity of 3 to 1. Thus, with one sweep of the dial, it is possible to tune from 30 to about 10 mcs. As there are frequently hundreds of strong signals to be heard within a small range, say 14 to 14.4 mcs, you can imagine that the tuning does tend to become critical. Yet you need a large condenser to tune over the broadcast band!

OUR APPROACH

A 100 mmfd. fixed condenser in series with the tuning gang limits the tuning range to something less than 2 to 1, which eases the position. However, the difficulty is that the bandspread obtained in this way tends to give plenty of spread at the low end, but very little improvement to the high end.

Still another approach is to tap the tuning condenser into some point in the coil to limit its tuning range. However, the sensitivity of the set tends to drop when a large capacity is lumped across portion of the coil, which has a relatively low capacity connected across its entire length.

You will appreciate that what may have been imagined a simple problem is actually nothing of the sort.

Assuming that a tuning range of 2 to 1 is required and the spread is required to be fairly even over the band, the most satisfactory solution appears to be to connect a condenser in series with the tuning gang and a further small condenser permanently in parallel with the coil to prevent crowding at the high frequency end of the band.

In practice, the idea works perfectly, the only criticism is the extra cost of components. An extra mica condenser is required and since three coils plus the condenser have to be switched, a four-pole switch is necessary. A four-pole switch on a single bank is not normally available, so that a 2 bank 3 x 3 switch is the only solution if you want the bandspread.

Actually, we have drawn the main circuit without the bandspread feature, and if you wish to make the

PARTS LIST

- 1 panel 11" x 7½"
- 1 chassis 10½" x 6½" x 2½"
- 1 pair of brackets 4" x 4"
- 1 power transformer, 150v a side at 30mA and 6.3V at 2A.
- 1 choke, 15H at 60 mA
- 1 speaker transformer, 5000 ohm to V/C
- 1 tuning condenser (.0004 mfd. approx.)
- 1 2-bank 3 x 3 switch

RESISTORS

- 1 .5 meg. potentiometer
- 1 .5 meg. ½ watt
- 1 .25 meg. potentiometer
- 1 .25 meg. 1 watt
- 1 .1 meg. ½ watt
- 1 .05 meg. 1 watt
- 1 250 ohm 3 watt

CONDENSERS

- 1 25 mfd. 40 volt
- 2 16 mfd. 525 volt
- 1 .25 mfd. 200 volt
- 1 .1 mfd. 400 volt
- 1 .01 mfd. 400 volt
- 1 .005 mfd. tubular or mica
- 1 250 pf. mica
- 1 100 pf. mica

VALVES

- 1 6AU6, 6AQ5 and 1 6X4.

SUNDRIES

Hook-up wire, small quantities of 24 & 32G B & S enam. wire, spaghetti, tinned copper wire, approx. 6" of ¼" dia. coil former, 5 tag strips (2 3-lug, 3 2-lug), 3 7-16 rubber grommets, solder lugs, 4BA nuts & bolts, 3 red terminals, 2 black terminals, power flex, power plug, 3 pointer knobs, parts for dial (see text).

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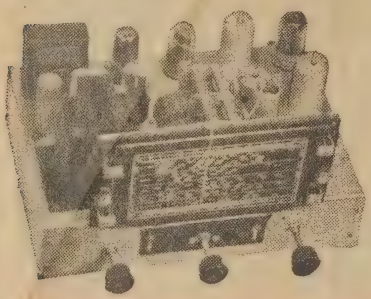

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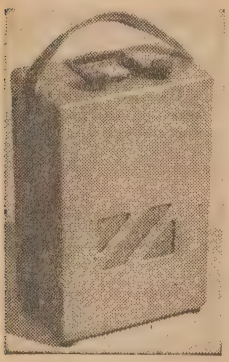

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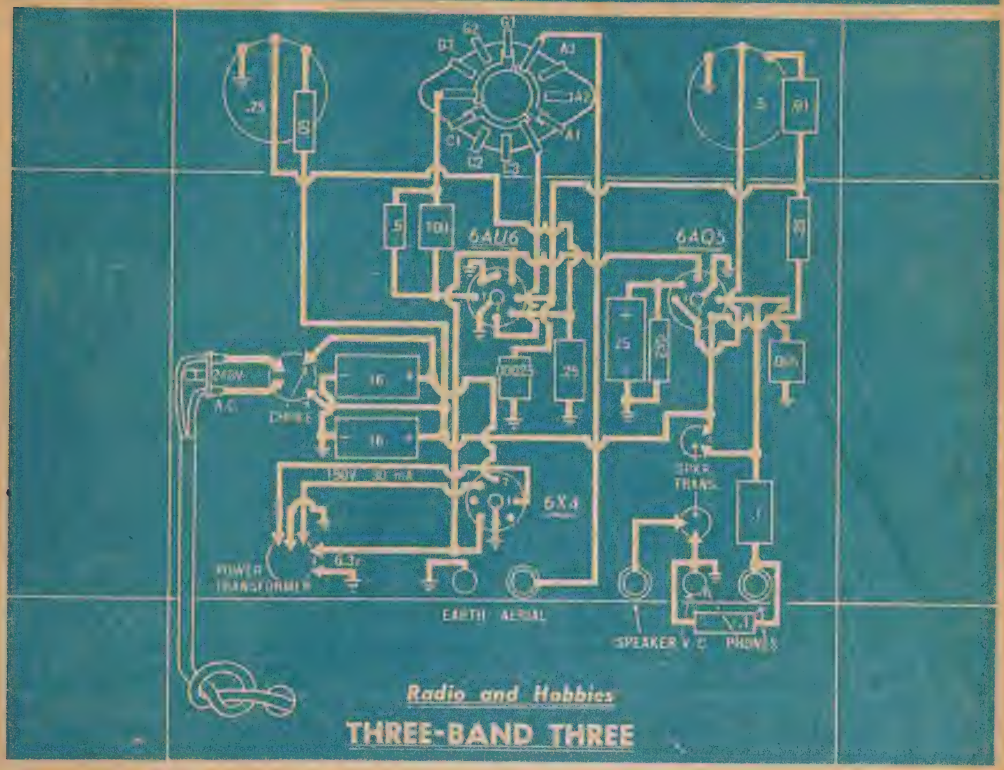
WIRING DIAGRAMS FOR THE NEW RECEIVER



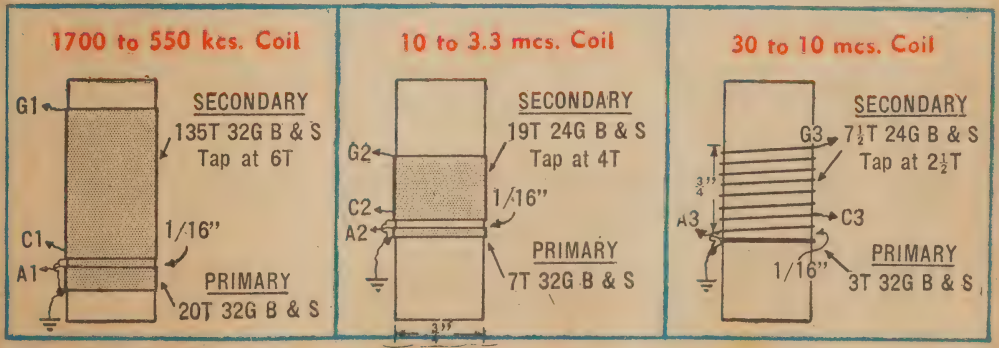
Every connection in the set is shown in this diagram. Where a valve socket lug is not available at the junctions, use a tag strip. Take particular care with the leads to the power mains.

coverage as wide as possible for general listening you can do so. On the other hand, if you are only interested in the more popular short-wave bands and do not mind the small extra expense, there is very little extra work required to include the bandspread.

While on the subject of coil units and bandspread we may just as well clear up some points about the relative merits of plug-in and switched coils.

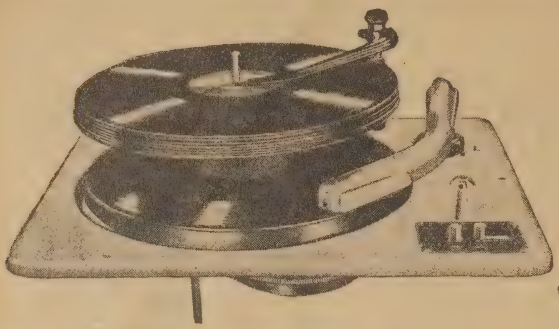
A few years ago plug-in coil formers were relatively cheap, while switches were quite expensive. Add to this the fact that it is very easy to experiment and adjust coils that can be entirely removed from the set, and you have a good argument in favor of plug-in-coils.

However, we checked on current prices and at the moment there is only a few pence to choose between the two methods. Switches were made in enormous quantities during the war and it would appear that manufacturing techniques have been streamlined so that they can now be made relatively cheaply, while plastic plug-in coil formers are an expensive item, as you can verify from any parts catalogue.



Details of the three tuning coils with the connections coded to correspond with the wiring diagram. Ordinary cardboard tubing can be used for the formers but if you can obtain bakelised paper or polystyrene so much the better.

two of the best . . .



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With coil data neatly worked out beforehand, there is very little argument. You will agree wholeheartedly, if you have had the experience of a large number of plug-in coil formers lying loose around the operating table, not to mention the inconvenience of having to change the coils rather than simply turn a switch.

Some of our younger readers may not be fully familiar with regeneration nor understand how it operates in practice, and a few words on the subject may not be out of place.

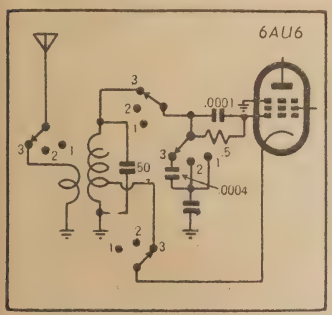
A regenerative detector differs from an ordinary detector in that a small amount of RF energy is fed back into the tuned circuit. When the amount of the energy fed back can be controlled within very fine limits, it is possible to operate the detector on the verge of oscillation and the losses of the coil itself are almost made up by the energy from the valve.

SMOOTH REGENERATION

Under this condition the "Q" factor of the tuned circuit is very high and both gain and selectivity are also very high. For best performance the detector should be operated on the verge of oscillation.

The regeneration is particularly smooth and easy to control with this set, and it is sometimes difficult to tell whether the detector is actually oscillating or not, in the absence of a signal. However, you will observe that there is a slight increase in hiss level at the point of oscillation.

For reception of unmodulated Morse code signals, it is necessary to have the detector oscillating weakly. Apart from defeating its purpose, strong oscillation may cause interference with nearby receivers.



This is the arrangement for bandspreading the high frequency range. With the constants shown the coverage will be from 18 to 9 mcs. The same principle can be applied to the other short-wave coil if desired.

As you tune across a signal with the detector oscillating, you will hear an audio beat note, which will decrease in frequency as resonance is approached. If you tune very accurately you will find that there is a point where no beat note can be heard. At this point the detector is tuned to exactly the same frequency as the signal.

For receiving Morse signals, tune the detector slightly to either side of the signal, so that a convenient beat note is heard. When there is interference from other signals, you will sometimes find that reception will be easier on one side or the other, or, if the interfering signal is not too strong but fairly close to the required signal you can tune it to "zero beat" and copy the required signal in comfort.

As you may have gathered, to get the best from a regenerative set, a little skill and patience is required, but it doesn't take long, and you will be pleasantly surprised when you find how well a properly adjusted job can compare with very much more advanced receivers.

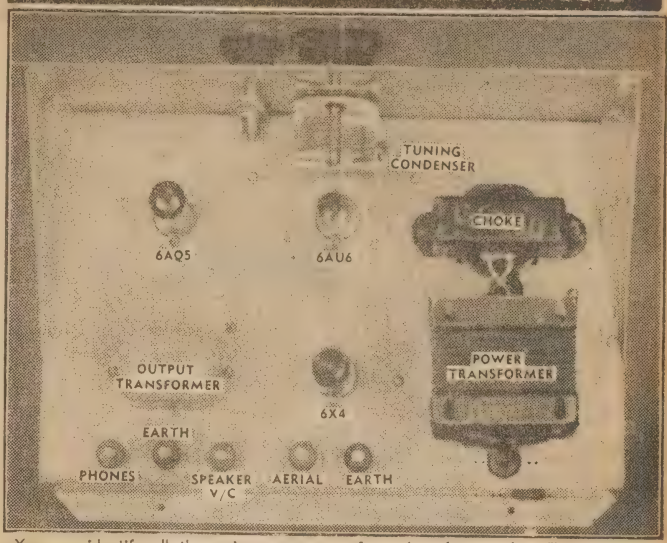
After a little practice you will be able to tune-in amateur and short-wave stations from all over the world.

As we mentioned earlier, it is desirable to have what is known as a straight line frequency characteristic where a given number of degrees of rotation of the condenser represents the same frequency change all over the dial.

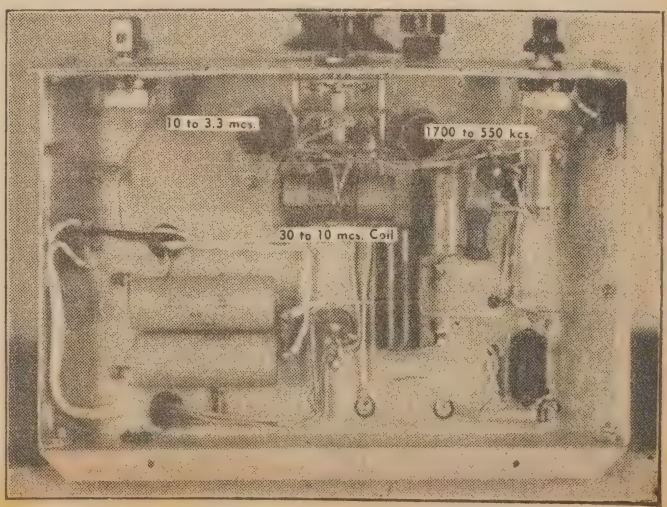
Where no special bandspread circuits are involved, this is almost entirely dependent on the shape of the condenser plates. To give the desired result, the capacity change should be slow when the plates are almost out gradually increasing as full capacity is approached.

A condenser with semi-circular plates will cause the stations at the

A REAR VIEW OF THE CHASSIS



You can identify all the major components from this photograph. The miniature components leave planty of room to spare on the top of the chassis.



The underneath wiring shouldn't take long but make sure that all the solder connections are neat and firm.

high frequency end of the band to be crowded close together and should be avoided, particularly where short-wave bands are involved. The Stromberg H and the AWA condenser both have specially shaped plates, but several of the miniature condensers similar to that shown in the photographs have plates which are almost semi-circular.

By the way, the final chassis blueprint, which we will send to the manufacturers, will show the valve socket mounted slightly further back to allow sufficient room for the standard size tuning condenser.

6AU6 DETECTOR

Although the circuit employs the latest valve types it is actually very little different in principle from the standard regenerative circuit, which has been popular for a number of years. A 6AU6 miniature sharp cut-off pentode occupies the detector socket. This valve has a fairly high gm and we found that it operates more smoothly with a grid leak of .5 meg rather than the 1.0 or 2.0 meg, which is traditional with valves such as the 6SJ7-GT. The cathode tap is made quite close to the earthed end of the coil.

The power output stage uses a 6AQ5 beam tetrode, which is electrically similar to type 6V6-GT, in a conventional circuit. The output terminals are so arranged that either headphones or a loudspeaker can be operated. It is very convenient to be able to use phones when other members of the household do not wish to be disturbed or for reception of weak signals on the shortwave bands.

A 6X4, which is a direct equivalent of the 6X5-GT, is employed in the rectifier socket and with the transformer and filter circuit shown the high tension voltage can be expected to be something in the order of 160. It is not likely that high power output will be required and the low voltage enables cheaper condensers to be used if you wish.

However, the standard 225-volt transformer may be used without change to the circuit constants, in which case the high tension voltage could be expected to be something in the order of 250. If you anticipate using headphones for most of your listening, the 150-volt transformer is the better choice.

SKILL REQUIRED

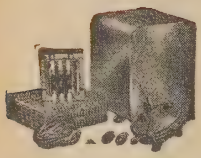
The dial is very important in any shortwave set so do not treat it as an afterthought. There are several manufactured dials you can use, but the better of them are fairly expensive.

We made quite a satisfactory dial from some scrap parts we happened to find around the workshop. A large and a small knob are required, together with a round metal plate about 3½ inches in diameter, a rubber grommet and a shaft and bearing from an old potentiometer. The pointer is simply a short piece of copper wire. Give the pointer and plate a coat of paint before assembly.

A rubber grommet of the type used for mounting gang condensers can be pushed over the shaft and, if the plate is allowed to run in the groove,

(Continued on Page 96)

Homecrafts



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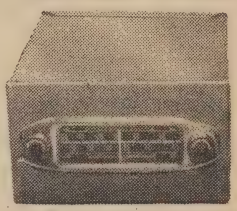

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A COURSE IN TELEVISION

PART 21—SAWTOOTH GENERATORS

The next two or three articles will be taken up with a discussion of sawtooth (or scanning or sweep) generating circuits, their requirements, their limitations and the types of circuit normally employed. The subject is one which must be clearly understood, since the ultimate picture relies so obviously on their correct design and adjustment.

THE subject is rather an involved one and there are many possible lines of approach. Probably the best one is to review the elementary requirements for scanning generators and then begin with the type of circuit already familiar to those readers who have used cathode ray oscillographs.

Two distinct scanning generators are necessary in every television receiver. The first moves the spot vertically at the field frequency rate which, in the case of Australian receivers, will be 50 cps.

LINE FREQUENCY

The second generator moves the spot horizontally at the line frequency rate, which is equal to the field frequency multiplied by half the number of lines. Alternatively it can be said to equal the product of the frame and line frequency. For the Australian standards, this yields a figure of 15,625 cps. This is somewhat higher than is involved by the present British and US standards but it is in "territory" familiar to audio enthusiasts.

The ultimate waveform, which is used to deflect the beam, must be as near triangular as possible in shape, as illustrated in figure 1. Ideally, the impulse should build up from A to B in a perfectly linear fashion and therefore carry the spot at an even rate from one side of the screen to the other, or from top to bottom.

At the moment when the spot reaches peak deflection the impulse should revert instantly to zero (B-C), ready to begin the next trace. This naturally applies to both line and frame scanning circuits.

It is not practicable to achieve an instantaneous "retrace" or "flyback" characteristic since, apart from anything else, such a degree of electrical acceleration would involve frequency components extending to infinity.

In practice, therefore, a good scanning waveform may resemble figure 1b, in which the flyback portion of the trace occupies a finite period of time.

This limitation applies to all scanning generators and is allowed for in the transmission standards by the provision of "blanking" periods. These hold the tracing spot to the "black" level for a period which is reckoned long enough for the respective oscillators to complete the retrace cycle ready for the next scan.

Very obviously then, the re-trace period at the receiving end must be kept sufficiently short, otherwise the return movement of the spot, or part of it, may be visible as spurious lines across the screen.

LINEARITY

A further obvious and basic requirement is that the forward trace be as near linear as possible.

If the scanning waveform is distorted as in figure 2a, it will mean that the movement of the spot across the screen will not be at an even rate. For example, a line oscillator exhibiting the output waveshape of figure 2b would move the spot rapidly from the left hand side of the screen towards the centre, slowing down as it approached the right hand side. A circular object would become egg-shaped, as illustrated.

Similarly, non-linearity in the framing oscillator leads to distortion in the vertical plane, while combination of the two can produce very peculiar effects indeed. Over-correction of non-linear distortion can produce an elongated "S" bend in the characteristic, as distinct from the simple convex and concave shapes.

Most television transmitters radiate a test pattern at intervals containing a combination of circles and lines which, among other things, allows the viewer to judge immediately whether the scanning circuits in the particular receiver are, in fact, linear.

PRECISE TIMING

Finally, before passing on, one other possible source of trouble must be eliminated for scanning generators, namely erratic timing or amplitude of the individual cycles of oscillation. This effect, as illustrated in figure 1c, may upset the interlacing, in the case of the frame oscillator. In the line oscillator, erratic behaviour will displace portions of the image to either side, giving the effect of roughness and lack of focus.

In considering the design of scanning generators it is necessary to remember that cathode ray tubes can employ either electrostatic or electromagnetic deflection. The first system, commonly employed in oscillographs and elementary television receivers, requires the application of a substantial sawtooth voltage to the deflector plates.

In practice, most modern television receivers employ large picture tubes and magnetic deflection and it is necessary to generate a sawtooth current in the deflecting coils. This involves some special considerations and, at the outset, it is easier to consider the basic sawtooth voltage generators.

Nearly all sawtooth generators

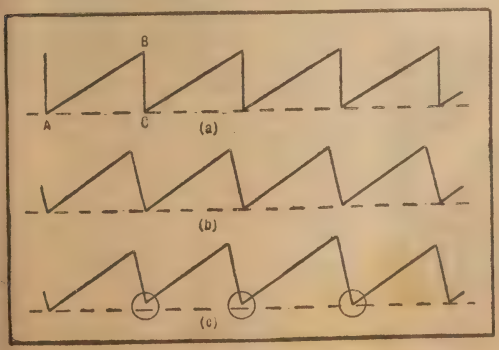

Figure 1 (left) showing (a) an idealised sawtooth waveform, (b) a practical waveform and (c) one having erratic tendencies.

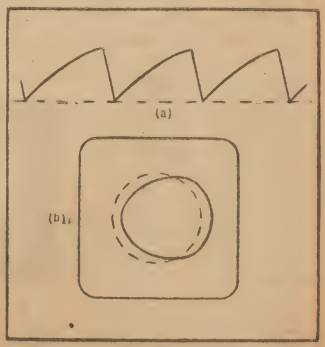

Figure 2 (right) illustrating the effect of non-linearity in the line oscillator. Circular patterns become egg-shaped.

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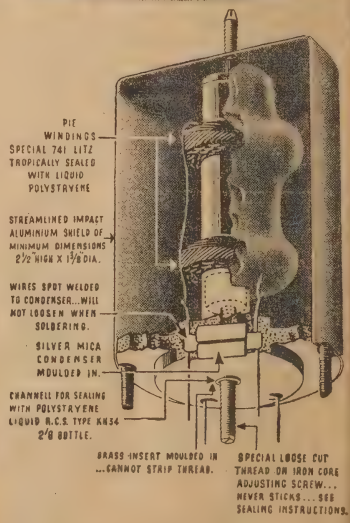

Illustrated above is the famous R.C.S. sealed I.F. with moulded condensers and welded wire ends.

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HOW WAVEFORM IS GENERATED

utilise the idea of charging a condenser through a resistive circuit to give the forward trace, and a rapid short-circuiting action to discharge the condenser for purposes of flyback.

The elementary action is illustrated in figure 3a. If a voltage "E" is applied to the network, the potential across "C", plotted against time, rises in accordance with the curve A-B in figure 3b.

If, when the condenser approaches maximum charge, it is suddenly short-circuited with a switch, the charge across it will be immediately lost. Opening the switch again will allow the charging cycle to be repeated and the net result will be an aproximate sawtooth voltage across the condenser.

ANALYSIS

Certain interesting observations can be made about this elementary circuit:

1. The general slope of the line from A to B, or the rate of charge, is determined by the time constant of the components C and R.

2. The period required to discharge the condenser is determined by the effective shorting action of the switch.

3. The condenser can be discharged at frequent intervals by operating the switch, the re-charging cycle starting immediately the switch is opened again.

It will be perfectly obvious that no mechanically operated switch would be suitable operating a time base and other means of discharging the condenser must be found. However, it is necessary also to consider the non-linear charging characteristic exhibited by the network. As we have already seen, this degree of non-linearity cannot possibly be tolerated in a television scanning system.

The reason for the curvature is not hard to find. At the beginning of the charging cycle, the full supply voltage is across the resistor and maximum current flows through it. As the charge across the condenser rises, the voltage across the resistor falls and so also, by Ohm's law, does the charging current through it.

IMPROVING CHARACTERISTIC

The problem can be countered by one of three basic methods:

1. Arrange matters so that the degree of charge and discharge involves only a small portion of the total charging curve.

2. Replace "R" with a device or a circuit which tends to hold the charging current constant, irrespective of the applied voltage.

3. Cancel the inherent curvature of the charging curve by a complementary degree of curvature elsewhere in an amplifier characteristic.

Taking the first instance, the supply potential "E" may be 400 volts and, if the charge and discharge cycles were allowed to run their course, something approaching 400 volts of sawtooth waveform would be available for deflecting the beam. However, the degree non-linearity would be such that it could not be used.

If, on the other hand, the condenser were allowed to charge only to 100 volts before being discharged, the linearity would be better but only about one quarter of the peak sawtooth voltage would be available for beam deflection.

In practice it is necessary to go even farther than this and to restrict the charging cycle to about 10 per cent of the supply voltage before good linearity is attained by this method. This generally involves the provision of extra amplification between the fundamental charge-discharge circuit and the picture tube deflection elements.

The alternative of using a very high charging voltage source is uneconomical.

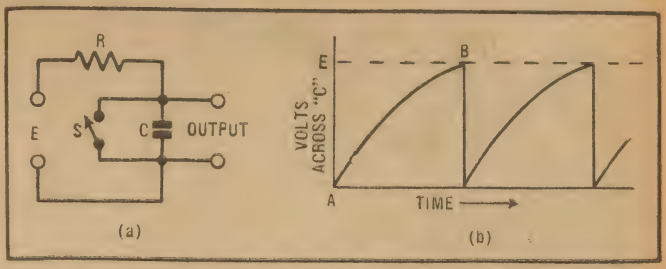


Figure 3. Most sawtooth oscillators use an R/C charging cycle, as illustrated by this elementary circuit.

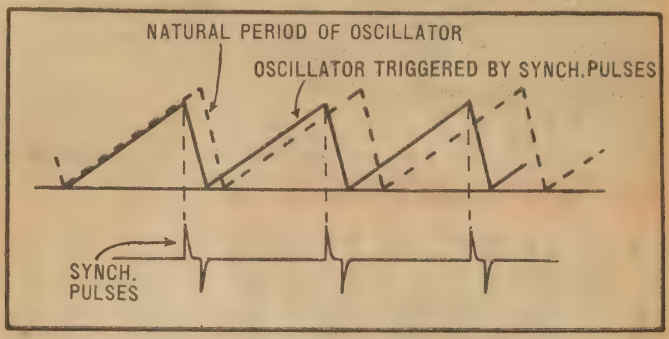


Figure 5. Showing how positive-going synch. pulses can lock or trigger a sawtooth oscillator, which has a frequency slightly lower than required.

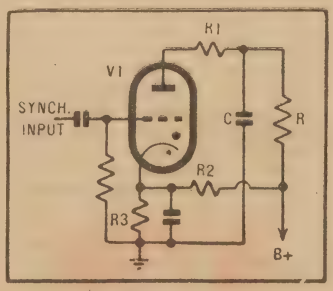


Figure 4. A simple gas triode sawtooth oscillator, as used in oscilloscopes. The linearity is generally poor, requiring additional circuitry to correct it.

The other methods of linearising the trace by controlling the charge current or by correction to the characteristic will be covered in the course of the article.

We are now in a position to examine a simple gas triode oscillator of the type commonly employed in test oscilloscopes.

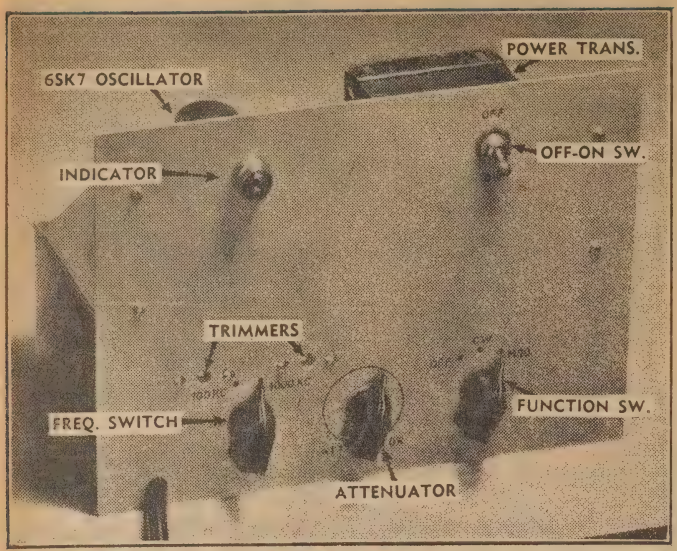
Figure 4 shows the normal gas triode oscillator, the basic charging components being designated still as R and C. When the voltage is first applied, there is no initial charge across C and therefore no initial plate voltage on the valve.

OPERATION

However, as we have already seen, condenser C will immediately begin to charge, and a gradually rising plate voltage will be apparent on V1. When the voltage reaches a certain critical value, the gas in the triode ionises, drops the impedance of the triode to a low figure and discharges the condenser to a relatively low voltage. At this point ionisation in the valve ceases, its internal resistance rises, and the charging cycle begins all over again.

Resistor R1 is included in the plate circuit purely to limit the peak current through the valve to a safe value. Its very presence in the circuit, together with the resistance in-

(Continued on Page 94)



The Radio and Hobbies

HARMONIC OSCILLATOR

The home builder is often faced with the problem of how accurately to calibrate the various pieces of gear he makes for himself. This novel unit will solve most of his problems by providing a series of accurate "marker" signals on all bands from the IF to the VHF regions. It is an inexpensive version of the traditional crystal calibrator.

by Philip Watson

CALIBRATION of communication receivers, signal generators, &c., calls for a large number of highly accurate signals. It is also desirable that they be evenly spaced around the band, as this makes interpolation of smaller divisions so much easier.

A simple method of achieving this is to provide an oscillator with a fairly low fundamental frequency, but rich in harmonics, so that signals on exact multiples of the fundamental will appear throughout the spectrum.

FREQUENCIES

Laboratory instruments designed for this purpose usually provide a choice of fundamental frequencies, the two most popular being 100kc and 1000kc. These are the values we have selected for the oscillator to be described. It provides coverage through the IF band, the broadcast band, and up to at least 20mc where 100kc signals will still have usable output.

Signals from the 1000kc fundamental extend considerably further than this.

Such an instrument should appeal to the serviceman, the general experimenter, and the amateur alike. The serviceman will find it useful for the alignment and calibration of both broadcast and dual wave receivers since, by providing a large number of signals equally spaced around the band, the need for continually re-setting the generator is avoided.

This results in a saving of time and makes possible a more accurate check of tracking and calibration, due to the larger number of check points available.

For example, on the broadcast band the 100kc setting will provide eleven points at which the calibration and tracking may be checked, and this involves no frequency re-setting as would be required with a generator. For the short-wave section similar convenience is provided by the 1000kc setting, which gives a check point at every megacycle.

However, this does not mean that the instrument is a complete substitute for a signal generator, since the latter will still be required to provide specific frequencies for IF channels, and also for sensitivity checks.

The experimenter and the amateur will find the new instrument a most useful source of signal for calibrating home-built communication receivers, signal generators, signal tracers, and similar pieces of equipment.

COST

The high degree of accuracy required for calibrating this type of equipment is easily obtained, providing a little care is taken. Often the calibration of an instrument is a bigger job than the actual construction, while the usefulness is always limited if the accuracy is in doubt.

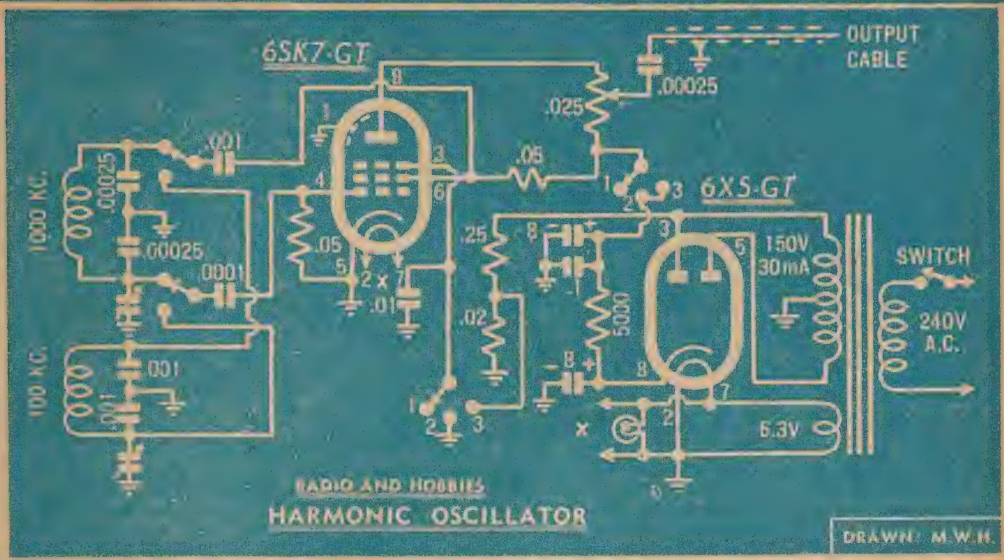
Apart from the matter of cost, the most satisfactory oscillator for this kind of work is undoubtedly the crystal-controlled type. However, suitable crystals cost many pounds, and this brings the total cost of the equipment up to a figure which would be excessive in most cases.

Our approach to the problem is to use a simple oscillator circuit, taking all possible precautions in the construction and the selection of components to ensure maximum stability. Semi-permanent adjustments are provided on the front panel, which permit the fundamental frequency to be shifted over a small range. The final frequency adjusment is made by beating one of the harmonics with a signal from a station known to be working on an exact multiple of the required fundamental. For 100kc this may be any broadcast station working on an exact multiple of 100kc, while the 1000kc may be checked on the short-wave band against one of the channels of the standard transmitter WWV.

ACCURACY

In many cases the accuracy of the instrument will be sufficient without the need for periodic checking, but where a high degree of accuracy is required it is quite a simple matter to beat a harmonic against your standard station while using other

IDEAL DEVICE FOR CALIBRATING RECEIVERS



The circuit is a simple one, straightforward and often employed in crystal calibrators. The function switch positions are (1) Stand-by. (2) Unmodulated R.F. (3) Modulated R.F.

harmonics to provide the required check points. These check points will then have a degree of accuracy approaching that of the standard station, and the PMG requires these to be accurate to within plus or minus ten cycles.

Briefly, the device is not intended to be an absolute standard in its own right, but rather as a means of extending known standards to other points in the spectrum.

On the other hand, the inherent accuracy may be regarded as being at least equal to, and in many cases better than, that available from all but the most expensive signal generators.

OSCILLATOR

The oscillator uses the well-known Colpitts arrangement, consisting of a single coil shunted by a centre-tapped capacitor. One advantage of this circuit is that it makes possible the use of standard coils and eliminates the need for special tappings, feedback coils, &c.

The oscillator valve is a 6SK7, which uses the cathode, grid and screen as a triode to which the resonant circuit is connected. The suppressor is at earth potential for RF signals, so that the coupling from the oscillator section to the plate proper is mainly through the electron stream.

The signals may be modulated or not as required, and this is achieved by returning the suppressor direct to earth for the unmodulated condition, and to a tap on an a-c voltage divides network for the modulated condition. This supplies about 14 volts of 50 cycle signal, enough to modulate the RF to a depth of approximately 30 per cent.

A third position on the function switch provides a standby condition where the HT is removed from the oscillator valve but the heaters remain energised, thus maintaining a more constant temperature.

The power supply is very simple, consisting of a small 150 volt per side transformer, a 6X5 rectifier, two 8 mfd electrolytics and a 5000 ohm resistor. No filter choke is required because of the low current drain, and the arrangement shown is quite adequate.

Some may deem it advisable to fit a voltage regulator, such as a VR 150/30, since mains variations will have some effect on frequency.

This tendency showed in our own experiments, but we are badly placed in this respect, our laboratory power often coming from an emergency plant. The variations are more frequent and severe than would be the case in the average suburban location.

For the 1000 kc circuit the grid winding of a standard broadcast aerial or RF coil is used, being tuned by two .00025 mfd mica condensers. The coil should be of the iron-cored variety, as this provides the means of making the final frequency adjustment. For convenience it is preferable to have the iron core adjustment on the top of the can.

The 100 kc circuit uses a winding from a 110 kc IF transformer which, quite apart from Disposals sources, is a standard line with at least one manufacturer. In its original form this unit was nearly four and a half inches high, which was rather larger than could be conveniently accommodated in our standard instrument box and still use a chassis of reasonable depth.

In order that it could be fitted into a standard 2½-inch can the following modifications were carried out. First the leads from both windings were unsoldered from the base pins and then the base itself was removed from the coil former. Approximately

PARTS LIST

- 1 R & H Standard instrument box 9 1/16" x 6 9/16" x 5½"
- 1 Panel 9 1/8" x 6 5/8"
- 1 Chassis 8" x 5¼" x 2½"
- 1 6SK7-GT valve
- 1 6X5-GT valve
- 1 B/C Aerial or R.F. coil
- 1 110 kc I.F. transformer
- 1 2 x 2 switch series 20 type 22
- 1 2 x 3 switch series 20 type 28
- 1 Toggle switch
- 2 Octal sockets
- 1 Power transformer 150V ct. 150V 30 ma 6.3V 2A
- 1 Indicator light
- 3 .00025 mfd mica condensers
- 3 .001 mfd mica condensers
- 1 .0001 mfd mica condenser
- 1 .01 mfd 200 volt paper condenser
- 1 .1 mfd 400 volt paper condenser
- 2 8 mfd 525 volt electrolytic condensers
- 2 Air dielectric concentric trimmers
- 1 .05 megohm ½ watt resistor
- 1 .05 megohm 1 watt resistor
- 1 5000 ohm 1 watt resistor
- 1 .25 megohm 1 watt resistor
- 1 2000 ohm 1 watt resistor
- 1 25000 ohm potentiometer
- PT 11 M cable
- tag strips
- 2 Alligator clips (type 147)
- 3 Small pointer knobs
- 3-core power cable.

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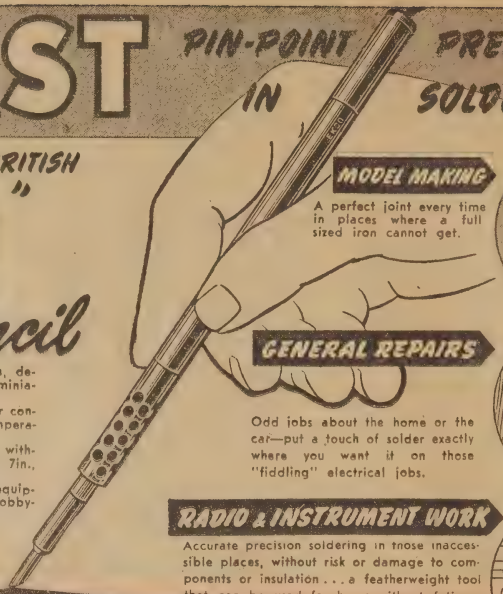

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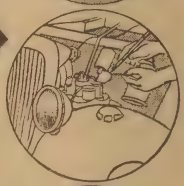

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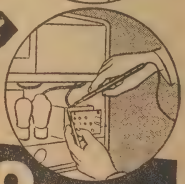

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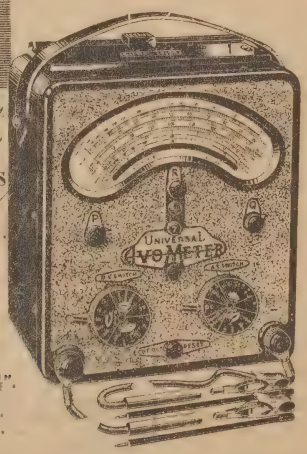

SIZE: 8" x 7¼" x 4½".

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The instrument is self-contained, compact and portable, simple to operate and almost impossible to damage electrically. It is protected by an automatic cut-out against damage through severe overload.

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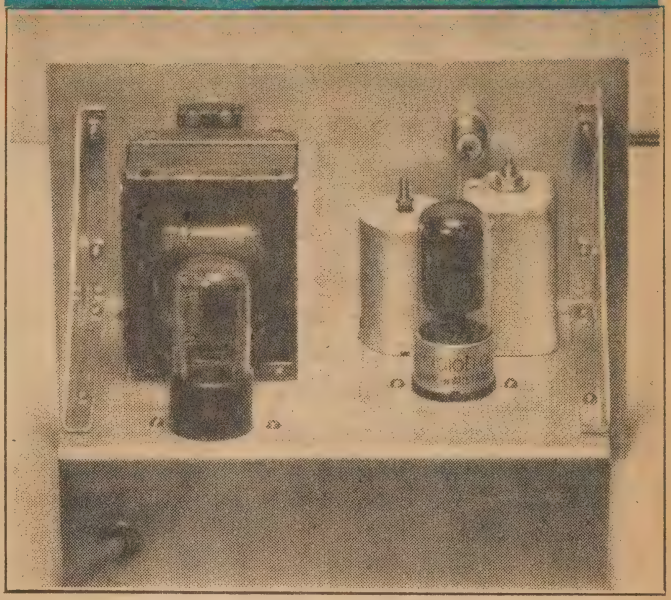
A REAR VIEW OF THE CHASSIS



This gives an excellent idea of the layout of the major components. The square can house the 100 kc coil, and the round one the 1000 kc.

1 5-8 inches of the coil former, which included the lower winding, was removed and the base replaced. The leads from the remaining winding were soldered to two of the pins and the whole unit fitted into a standard can.

If such a can is not available it should be possible to cut the original one to a suitable length, and refit the threaded eyelets.

The construction calls for absolute rigidity of all components and wiring which may in any way affect the frequency of the tuned circuit. This applies not only to the tuned circuit itself but also to any of the wiring which may be close enough to affect it, even though it may not be carrying RF signals.

We strongly recommend that the layout should follow closely on the lines of the original, which permits the length of vital leads to be kept to a minimum. Most of the wiring was done with eighteen gauge tinned copper wire sheathed with spagetti tubing where necessary.

In the case of the filaments this was not practical and hook-up wire was used, but any leads which might affect the tuning were clamped to the chassis with solder lugs.

As will be seen from the under chassis photograph several tag strips have been used to provide anchor points for various components, and this further assists in keeping everything firmly mounted.

To assist our readers to follow the original layout, we are preparing a chassis blueprint, which will be available from our office at the usual charge of 2/6.

The trimmers used to provide the fine frequency adjustment are of the air dielectric, concentric type, which are easy to mount and have a good degree of mechanical stability. They are located directly under their respective coils, and their pigtails reach easily to the coil pins.

OUTLET CABLE

The attenuator is a 25,000 ohm carbon pot. and output is taken from this through a small mica condenser (.00025 mfd.) to a shielded output cable. In our case we used a length of low loss cable type PT 11 M, which is similar to the type PT 1 M we have often recommended for audio circuits. The main difference is that the PT 11 M uses a stranded rather than a solid conductor, and is therefore more suitable as a flexible lead.

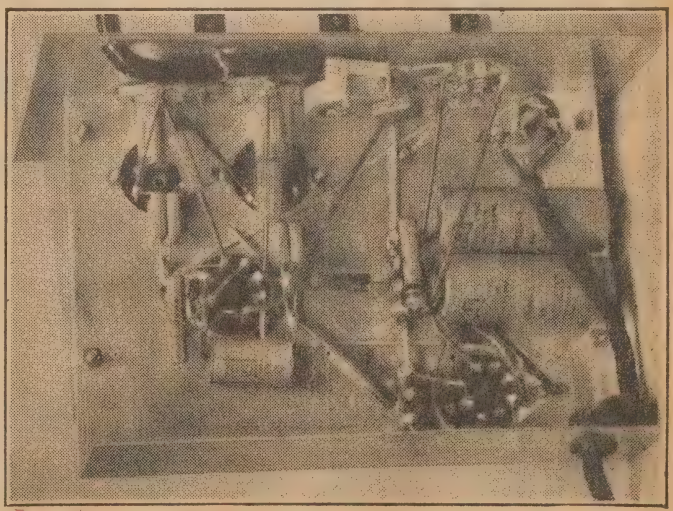
Quite apart from its improved electrical characteristics, it is decidedly more robust than the ordinary run of shielded wire, and makes a much more workmanlike job. However, those who are unfamiliar with it may encounter some minor problems in handling it, and some comments on our own approach may help.

As with most plastic insulation, the material used melts at a rather low temperature, although it is better than most in this respect. To strip the end, proceed as follows:—

Remove about an inch and a half of the black outer sheathing, by cutting around it with a sharp knife. It is now quite easy to unravel the shielding braid, and it makes a much neater job than cutting it. Unravel it as far as the black sheathing, and then twist the loose strands together to make a solid conductor. It is not difficult to solder to the end of this without applying excessive heat to the insulation.

The insulation may be stripped from the central conductor by simply cutting around it with a sharp knife, but be careful not to cut any of the strands. Soldering to this will not damage the insulation, providing the iron is hot and clean and a small quantity of flux is applied to the wire first.

The free end of the cable is terminated in a alligator clip, and a very good job can be made by using one of the type normally used to fit on test prods (type 147). It will be found that the tubular end of



This under chassis view will help you to duplicate our original layout. The 6SK7 valve socket is on the left, with the coils and trimmers above it. The function switch is seen on the right

this type of clip will fit neatly over the insulation of the cable after it has been stripped of braid. The centre wire is soldered to the body of the clip, which is then clamped tightly on to the insulation to prevent any strain on the wire.

Six or eight inches of flexible hook-up wire is soldered to the strands of the shielding braid, a piece of spagetti tubing slipped over the lot, and the free end terminated in another alligator clip.

For the calibration you will require a receiver covering both the broadcast and at least one short-wave band, and having dial calibrations of reasonable accuracy.

Before calibrating, or indeed before any accurate measurements are attempted, ample time should be allowed for the instrument to reach a stable operating temperature. Reasonable stability is reached after about 15 minutes, and at least this time should be allowed before calibration. Many will no doubt find it convenient to leave the unit running for long periods in the stand-by position, as the power consumption is negligible.

CALIBRATION

From the list of stations included elsewhere in this article, select one within the range of your receiver. In most localities there should be at least one available, although in some cases it may only be at night. If it is a distant station to which you do not listen regularly, obtain positive identification before commencing calibration.

When using a local station it may be necessary to reduce the signal strength from it, which otherwise may be too strong to allow a satisfactory beat note to be obtained. This may be done by using a short length of wire only for an aerial, or by coupling the aerial through a small capacity, such as a few inches of twisted hook-up wire.

On the other hand, a weak station will need to be fed directly to the set, and the coupling to the oscillator may need to be reduced. In this case simply clipping the oscillator lead on to the insulated aerial lead is usually satisfactory.

Set the oscillator to the 100 kc band, and adjust the iron core until a beat note is heard. This may mean that the fundamental is on 100 kc, but is not conclusive, and some further checks must be made. For example, a beat note may be obtained at 1200 kc from the twelfth harmonic of 100 kc or from the eleventh harmonic of approximately 109 kc.

HETERODYNES

Another misleading effect is caused by a harmonic from the standard oscillator beating with the local oscillator of the receiver. This may be identified by slightly altering the receiver dial setting, which will cause the beat note to change pitch. When the beat is really between the standard oscillator and the broadcast station a change of receiver tuning will only cause a change in volume, but not in pitch.

Having selected what appears to be a true beat, adjust it carefully to zero. Now disconnect the aerial, and switch the oscillator to the modulated position. Tuning the receiver over the broadcast band will produce a series of signals at regular intervals, and they should be 100 kc apart as indicated by the dial calibrations.

If they follow the dial markings fairly closely it is reasonably certain that the correct fundamental has been selected. If a second station is available on a 100 kc multiple, a positive check may be made immediately. If not, further checks may be made when the 1000 kc section has been adjusted.

THE following is a list of Australian Broadcast Stations operating on Multiples of 100 kc:-

CALL SIGN	LOCATION	KILO-CYCLES
	NSW	
2NR	Lawrence	700
2BA	Bega (projected)	800
2LM	Lismore	900
2PK	Parkes	1400
2BS	Bathurst	1500
	VICTORIA	
3HA	Hamilton	1000
3AK	Melbourne	1500
	QUEENSLAND	
4LG	Longreach	1100
	TASMANIA	
7ZL	Hobart	600
7AD	Devonport	900
7LA	Launceston	1100
	SOUTH AUSTRALIA	
5KA	Adelaide	1200
5AU	Port Augusta	1400
	WESTERN AUSTRALIA	
6WN	Perth	800
6MD	Merridin	1100

Before commencing the accurate calibration of the 1000 kc section, an approximate adjustment can be made on the broadcast band. Using a modulated signal the frequency may be adjusted to the 1000 kc marking on the dial. If you are fortunate enough to have a broadcast station on this frequency an accurate adjustment can be made by beating an unmodulated signal against it.

Few will be as fortunate as this, however, and other standards must be sought. The most satisfactory for this work are the standard transmissions of WWV, which may be heard on most short wave receivers. These transmissions are made on the following frequencies, 2.5, 5, 10, 15, 20, 25, 30 and 35 megacycles.

FINAL CHECK

Having made an approximate adjustment on the broadcast band, it is now only necessary to make a fine adjustment by beating a harmonic against one of these standard transmissions. Signals should now be available on every megacycle throughout the short wave bands and by carefully noting the position of two of these signals it will be possible to make a final check on the accuracy of the 100 kc section.

Signals from this should divide the area into ten equal sections, or, in other words, there should be nine signals occurring between the two 1000 kc marker signals.

A point to watch when working on the short wave band is the tendency for most sets to double spot.

(Continued on Page 92)

IS THE SET REALLY FINISHED?

The last resistor is in place, the last joint soldered. You put down the iron and admire your handiwork. Yes you've made a neat job, even if you do say so yourself. And, if the circuit is all that the writer claims for it, the performance should be really super.

BUT, hold on! Before you reach for that power cord, is the set really finished? Are you sure that everything is in, and in the right way? In other words, has it been thoroughly checked? No?

I was afraid of that. All right, let's give it the once-over.

It is most important to check on those things which, if incorrect, would cause damage to valuable components.

POWER LEAD

First comes the power transformer. Is the power cord correctly connected? Check this at both ends. If using a three-core cable, see that the green wire goes to the earth pin of the plug, and to the chassis of the receiver. Better still, check it with the multimeter.

I'm being over cautious?

Don't you believe it! A receiver chassis with an incorrectly wired power cord can be lethal, so don't take chances.

Now the actual primary connections. Did this transformer have a primary tapping for 220 volts? If so, make sure that the power is not wired between the 220 and the 240 volt taps. Again, the low ohm meter will enable you to make quite sure. Yes, I've seen it happen, and what it does to the fuses, the transformer and the valve filaments is just a shame!

Next, the electrolytic condensers. Is the polarity right? If you are using a lower voltage type for the second position, is it in fact in that position? Transposed into the first position, directly across the rectifier, it could easily break down, and a short circuit here can ruin a rectifier while you are still grabbing for the power switch.

CHECK THAT WIRING

While we are about it, check all the wiring around the power supply and the connections to the rectifier socket. And, speaking of the rectifier socket, remember you had some difficulty soldering to one of the pins? So you used some soldering paste, and now there is quite a layer of the stuff between the two high-voltage pins. It may not matter immediately, but as soon as it collects some dust you'll be in trouble.

How to remove it? A tooth brush soaked in methylated spirit will work wonders. But don't let the tooth-brush get back into the bathroom. Just think of it, soldering paste, tooth paste and metho. Ugh!

The power valve is something which can be damaged through incorrect wiring, so this is our next check point. If self-bias is used make sure the electrolytic by-pass is right way round. Too little bias on a power valve can be serious. Equally serious is voltage on the screen, but not on the plate, so check for continuity between the screen and plate pins with the speaker plugged in.

The filament wiring should be given a careful visual check for possible shorts, with particular attention to the dial lamp holders. With one side of the filament earthed, shorts at this point are by no means rare. It is a good idea to fit the lamps at this stage.

If all appears well, most of the serious danger points will have been covered, but be patient just a little longer and give the rest of the circuit a careful check. Keep your eyes open for odd blobs of solder, which have a habit of hiding in out-of-the-way corners. With all the valves removed it won't do any harm to turn the chassis right side up and bounce it a couple of times on the bench.

FILAMENT VOLTS

Of course, you're still itching to turn the power on. All right, then, but no valves yet, and if you have an a-c voltmeter, check the filament volts. If not, watch the dial lamps and note whether they are lighting to normal brilliance. A low voltage here probably means a short, which will be confirmed by overheating of the filament wiring. The transformer will overheat soon, too, but don't wait for that to happen.

Now the valves may be plugged in, with the exception of the rectifier, and the filament wiring is given its final check as each of the filaments start to glow. Take particular note of the power valve, since a cold cathode will mean that it will draw no current from the power supply. No current drain can mean excessive voltage, broken down electrolytics, burnt out rectifiers &c.

All filaments lighting normally? Good. Switch off and plug in the rectifier. Connect the multimeter to the H.T. circuit, make sure the speaker is plugged in, and switch on. Keep one eye on the meter and the other on the rectifier (Oh yes, it can be done) and watch for danger signals. These are, zero or low voltage after the cathode has had time to heat, and a blue glow in the rectifier envelope after the same period.

Some times there is a faint blue glow for a second or so as the valve reaches operating temperature, but this is not to be confused with the persistent display which indicates that there is a H.T. short somewhere.

If the H.T. voltage seems normal and the rectifier is not getting hot under the collar, you can start looking for stations. Whether you find any or not still depends on how well you have wired and checked the set. After all this, if you have made a minor error, you can feel reasonably sure that it will not cause a major component to disintegrate.

BATTERY SETS

Of course it may be a battery set you have just completed, in which case all the above words of wisdom will have gone for nought. But don't think we can't assume errors on your part, too—in fact nothing could be easier. Once upon a time an optimist used to be defined as a man who started a crossword puzzle with a pen and ink. In this day and age, he might well be defined as one who switched on a battery set without testing it.

The most serious (and by that I mean the most expensive) fault which is peculiar to battery sets, is one which occurs in the filament circuit. In any battery set the normal circuitry calls for one side of the filaments to be connected to one side of the H.T. circuit. This means that a very simple error is all that is needed to apply H.T. to the other side of the filament circuit, and, behold, you are four or five valves "in the red."

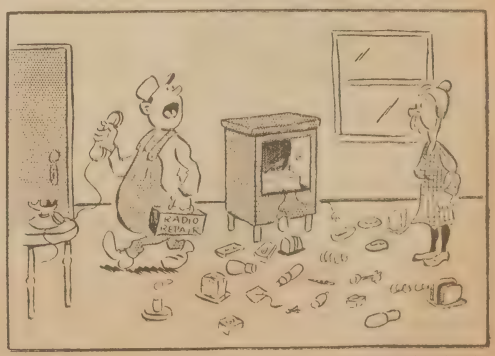
Next in order of seriousness is a short in either the H.T. or L.T. battery circuits, which can take energy

(Continued on Page 92)

☆

Well goodbye! My wife says I've just been called up.

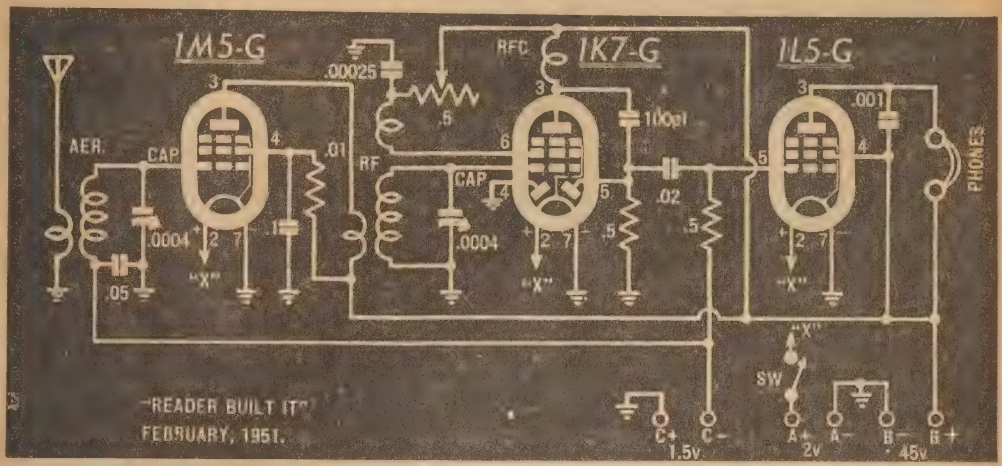
☆



A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

TWO INTERESTING BATTERY CIRCUITS



This three-valve set is simple and yet should perform quite well. If you have a double-pole switch, switch the B-plus lead as well as the A-plus shown in the diagram.

Unusual circuits, however slightly they may differ from a standard arrangement, never fail to catch the eye of the older constructor or the budding experimenter. These two simple circuits, sent in by a New South Wales reader, show the development of a one-valve set to a three-valve version.

IN a recent letter our contributor, Mr. C. Gates, of "Ubinia," Balladoran, 4W, NSW, tells how he wanted to try a one-valve set which would be a little different, and yet effective enough on the broadcast and medium shortwave bands. The circuit at the bottom right is the result.

It is simply a regenerative RF amplifier feeding into a diode anode for detection in the same envelope. Other diode-pentodes may be used, a possible choice being the 1S5.

PLUG-IN COILS

For multiband coverage, plug-in coils are the obvious choice. If broadcast band operation only is contemplated a standard Reinartz coil could be soldered in place and left at that. The tuning capacity will need to be of the standard size having a maximum capacitance value of about 400 pf (0.0004 mfd.)

The three-valve version retains the 45 volts of high tension, the point being that it is intended still as a headphone set but with increased sensitivity, selectivity and output power. The battery drain will be fairly low.

The first stage carries a 1M5-G although other types could be used such as the 1K5-G or even the pentode portion of a 1K7-G. The absence of an RF gain control is usually of no great consequence in country areas where the broadcast station field strength may not be as high as it is in metropolitan areas. However, where there is liklihood of very strong stations being tunable, it would be necessary to use a short aerial or provide a potentiometer control over the screen voltage to avoid overloading this or the succeeding stages.

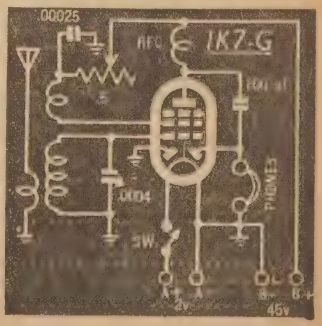
A.V.C. might alternatively be of assistance in such a case. It would involve connecting the lower end of the 1M5-G grid coil to the diode anode through a 1 megohm isolating resistor. The 0.05 mfd. capacitor bypassing the bottom end of the coil to chassis would be required but no battery bias should be applied as it would also bias the detector diode anode.

With two tuned circuits to control, a two-section tuning gang is normally required for single knob control. Trimming capacitors would be required across each section of this gang for circuit alignment at the high frequency end of the band.

The resistor and capacitor at the screen of the RF stage are not really necessary with a 45-volt supply and could be dispensed with. The difference in drain with these components in or out of circuit would be unimportant.

The minus 1.5 volt bias for this stage is optional. However, as this bias is desirable for the output stage, it is simply a matter of either earthing the bottom end of the aerial coil or connecting it to the bias cell as

(Continued on Page 75)



Standard coil data will apply both for this set and the 3-valve version above.

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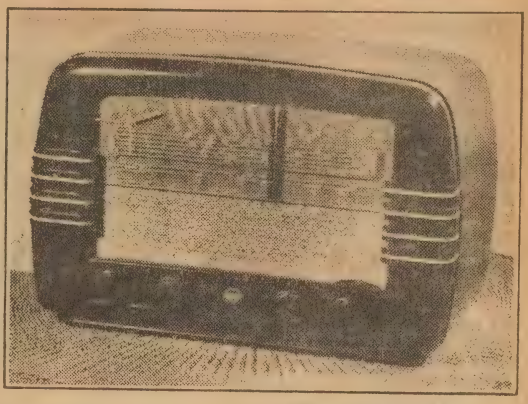
TRADE REVIEWS AND RELEASES

MULLARD RECEIVER FEATURES S-W BANDSPREAD

One of the latest additions to the "Mullard" range is the model "Eleven Eleven" five valve mantel receiver. It uses the new "Innoval" series which makes possible a very high gain within the scope of four amplifying valves. Special attention has been paid to the shortwave section and the receiver is very impressive and smooth in operation.



IN addition to the normal shortwave tuning range, taking in the 16 and 49 metre bands, the model "Eleven Eleven" includes a bandspread range which enables the popular 25 and 31 metre bands to be spread over the entire length of the dial. It makes tuning shortwave stations almost as easy as tuning broadcast stations and, in addition, makes it a simple matter to log stations for future reference.

The converter stage employs the miniature triode-heptode type 6AN7 which is electrically similar to types 6J8-G, X61M, &c. The low noise level of this type ensures good signal to noise ratio on both bands. Naturally, image rejection is not as good as with more complex designs employing an RF stage, but is up to standard for this type of receiver.

A single stage of intermediate frequency amplication at 455 kcs, employing a 6N8 is included and another 6N8 is used for the audio voltage amplifier. The audio power output valve is a 6M5 high gain pentode. The rectifier socket is occupied by a 6X5-GT.

A feature of the set is the large straight-line dial with a well chosen ratio. It is calibrated for use in all Australian States, with stations in capital cities printed in larger type.

Controls from the left are, on-off switch and tone control, volume, tuning and on the right, the band selector switch. The extreme anti-clockwise position of the on/off switch and tone control knob switches the set off. One click of the switch in a clockwise direction switches the set on and provides the normal full tonal range for average listening.

A further click in a clockwise direction adjusts the audio amplifier to emphasise the speech range and is particularly valuable for listening to plays, talks, news sessions, &c.

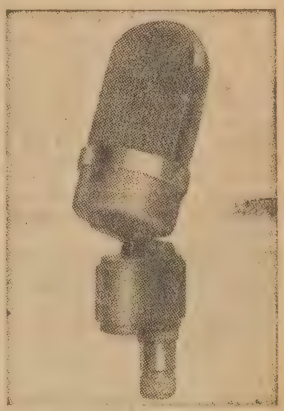
Provision is made for attaching a gramophone pickup to the receiver by means of a pair of pin jack terminals at the rear of the chassis. Volume and tone can be controlled from the front of the set in the normal way when the pickup is in operation.

At the moment the bakelite cabinet is only available in mahogany tonings. Retail price is £39, including valves.

NEW BRITISH MICROPHONE

BRITISH Merchandising Pty. Ltd., of 183 Pitt Street, Sydney, announce that they have stocks of a new English microphone which should be of interest to advanced amateurs and professionals.

This is the Trix model G7821 ribbon microphone available in either high or low impedance, the



latter being at 30 ohms. It has an adjustable tilting head and is fitted with a screened connecting plug and locking ring.

The manufacturers claim a response which is substantially free from peaks and is, in fact, flat within 2db from 40 to 10,000 cycles.

British Merchandising advise that tests which they have carried out themselves fully substantiate the manufacturer's claims.

The retail price is £20/5/-, including sales tax.

AWV VALVE DATA BOOK

Up to date technical information on latest valve types is a "must" for all those associated with electronics. The latest AWV valve data book should be a valuable addition to any technical library.

AMALGAMATED Wireless Valve Co., 47 York Street, Sydney, have recently announced a new Radiotron valve date book for 1951. This is intended to provide completely revised and up-to-the-minute data on Radiotron valves, both Australian and imported.

Consisting of nearly 400 pages, it will contain the most comprehensive data likely to be required by the design engineer, serviceman, or experimenter.

In addition to the valve operating conditions, base connections, physical dimensions, &c., there are sections devoted to resistance capacity coupling data, and modern circuit design for miniature valves.

Not the least attractive features are the convenient size (7¼" x 5"), and the new spiral binding. This latter is particularly timely, as anyone will testify, who has struggled to keep open many of the old-time data booklets.

The price of this publication is to be 5/-.

U.C.C. AT NEW FACTORY

LATE last year United Capacitor Company established something of a record when they moved to their new factory premises at 433 Punchbowl Road, Enfield. The change-over was effected in three days, which, being conducted over a weekend, resulted in very little loss of production.

A HOME-MADE SPOT WELDER

Not many readers realise that simple spot welding jobs are entirely within the capacity of the home workshop. This article describes a unit suitable for operation from a storage battery. The addition of a transformer will adapt it for power mains operation.

MOST readers can soft-solder and some can braze and weld, because these processes require little apparatus. Spot welding is entirely electrical, the two metals to be joined being brought to fusing temperature over a very small area, hence the term "spot."

Briefly, the work is placed between two pointed electrodes, which are brought together with as much pressure as possible, and the current is then switched on for a fraction of a second. On examination, the metal is just joined over a pin spot.

At the point of contact, the resistance is so high and the current so strong that the heat produced is enough to melt the metal. In practice, several spots can be placed side by side, but never one spot over another.

CURRENT, VOLTAGE

Currents vary from 100 amps upwards, and the voltages from 1.25 to 7.5 or slightly more. It must be understood that if these large currents are to flow at the low voltages mentioned, the resistance of the circuit must be very low. Hence, all leads are as short and as fat as possible, and the only material to use is copper of the best quality.

In this article we only deal with a small machine for model work and light shop use. A spot welder can be used in almost any job that reqiures the quick, clean and sure joining of metals. Of course, a spot welder cannot make a watertight seam, and for this a special machine is required with revolving electrodes, &c.

Since the advent of stainless steel, the welder has been very prominent in dentistry and other professions where fine wires require joining.

Fig. 2 Electrodes welding two wires at right-angles.

We cannot enumerate all the uses of the welder, but after one has been made and installed in the shop, it will be found as useful as the machine vyce.

The two types of welder to be described are actually identical in detail, but the power supplies are different. The first is battery-operated, and the second draws its power from the mains through a transformer. Details for making a transformer will be given next month.

BATTERY SUPPLY

To supply the necessary current a six-volt high-capacity battery will be required. A car battery of the lead-acid type is quite good, especially if it can be trickle-charged from the main. It must be a multi-plated cell of very low resistance and fitted with suitable and large terminal posts.

The voltage to the electrodes is varied by changing the tappings on the battery. A suitable battery is one of the nickel-iron type. The big alvantage of these cells is that they can be left for long periods without deteriorating in any way.

The actual construction of the welder is very simple and can be followed from the illustrations, Figs. 2 and 3.

First obtain a good supply of copper rod, ¼in square; about 18in will be required. The first welder, being battery operated, is actually mounted on one terminal post of the battery so as to do away with one lead.

The lower limb of the welder is 8in long and is bolted to one terminal of the contact maker or switch. The pillar is 5in long, and is fixed to the limb by a ¼in copper bolt tapped into it. The two surfaces must be filed dead flat and the pillar must be at right angles to the limb.

LOW RESISTANCE

Screw up as tightly as possible, but remember copper is soft and will strip easily. When tight, soft solder must be flushed all round the pillar to make a good join, and, if possible, get it to run between the metals.

The top arm is movable and hinged over the pillar.

In order to make this arm free to move and yet obviate side play, i.e., so that the electrodes will meet when they are closed, the suspension bracket is made as wide as possible; in this case about 4in.

The top arm is a little longer than the bottom and is drilled with a 5-16in hole 2in from one end. Through this hole a rod has to pass and is secured so that it does not make electrical contact with the arm.

Reamer out the hole to a little over 5-16in. The supporting rod

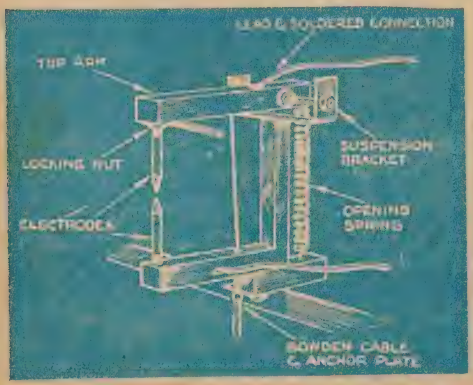


Fig 3 The complete welder.

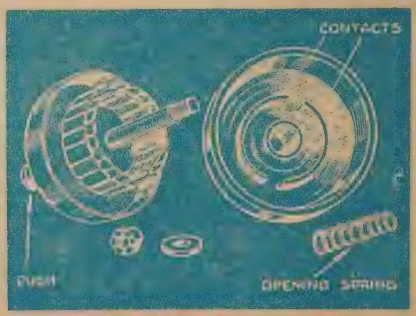


Fig. 4 Details of the contact switch

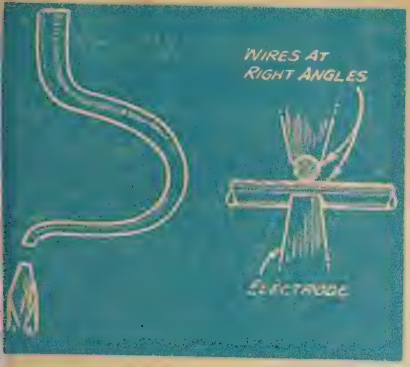


Fig. 6 (Left) Swan-neck electrodes. Fig. 7 Position of electrodes for wire welding.

is of brass, ¼in diameter, threaded any suitable number per inch. Study the various sketches to get a good idea of the general layout of the machine.

Slip a length of thin-walled rubber tubing on to the rod and then push this into the arm. It should be a tight fit. Screw up the nut tightly, so that the arm is rigid (Fig. 5). Test on 6 volts or higher if possible.

THE BRACKET

The bracket is of brass strip ¼in by ⅛in bent to shape and fixed to the pillar with one screw and soft solder. It will be observed that the arm is insulated from the remainder of the machine.

The upper arm is centred over the lower and held in place by two nuts on either end of the threaded rod.

These electrodes are made from 3-16in or ¼in diameter hard copper rod to any shape desired. It is essential that the welding current, in order to get a spot, be concentrated to or over a small area, and therefore the electrodes are blunted to form a flat point of approximately 1-32in diameter, depending, of course, on the material to be welded and the capacity of the machine.

ELECTRODE

For thin steel plate of tin-plate gauge, a diameter less than 1-16in should be used, the point to be quite flat and kept in this condition by an occasional touch with a fine file. The pointing of the electrodes can be easily accomplished with a file.

Make the points fairly blunt, but do not have a long taper to them like a needle. The heat of the weld will soon soften the end, causing mushrooming, and faulty welding will result.

The upper and the lower electrodes are both the same for simple plate welding and should be about 2in in length. Each one is screwed into its respective arm and adjusted so that the points meet.

A good plan is to make some electrodes larger than others so that the gap is not in the centre, but can be made higher or lower according to the electrodes used. This is an advantage when awkward slopes are being welded.

The electrodes are threaded any convenient size and then fixed in holes in the arms. In order to lock them in the arms make small adjusting or locking nuts from strips of copper and tin them to fit the electrodes.

A pair should be made for each pair of electrodes and must be fitted to them; this will save a lot of time when the pairs have to be changed.

We will deal with the types of electrode required before going on to discuss the method of using them for welding.

In some cases it is necessary to weld on the outside of a cylinder like the handle attachments on a tin can or "billy" can. A straight lower electrode cannot be used and a special swan-necked one is required.

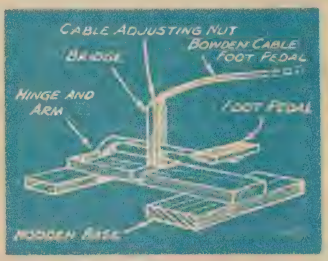


Fig. 4 The foot control

Make this from similar material as before, and turn up the end to just touch the upper one. The depth of the neck will depend on the distance along the tube that is required to weld, but if this is greater than 1in or so, make the electrode from stouter material.

SPECIAL ELECTRODE

A swan-neck is required for all work where the article is said to be undercut, such as rings and tubes of no great length, etc. (Fig. 6).

Wires have frequently to be welded together at right angles and at a simple tap joint. In these cases, straight electrodes must be used with grooves in them to accommodate the wire. The depth of the groove must be just under half the diameter of the wire, as its function is to firmly hold the wire and get as big a current as possible.

For right-angle welding, the grooves are at right angles, and in the same line for tap joints (Figs. 2 and 7). Of course, they can be in any other intermediate position.

In the original machine the contact switch used was a starting switch from a motorcar (Fig. 1). We advise readers to obtain a switch rather than to make one. A suitable one can usually be obtained cheaply from a "breaker's yard."

Dismantle the switch and clean it, trim the contacts and make them true, and remove the powerful spring that normally works the switch, and fit a light one. If your switch is foot-operated, this is essential because it is hand-operated on the welder.

It should be possible to make contact with one finger and yet the switch must open quickly.

Oil the sliding mechanical parts but not the electrical ones. The switch is bolted directly to the bottom arm of the welder by the contact screw on it. It is a good plan to make this contact to the frame of the switch so that both are firm mechanically and a good electrical join results. The other switch contact is connected to one pillar of the battery.

WELDED CONTACT

To keep all leads as short as possible, it is necessary to have this contact welded to a battery terminal clamp; the usual battery clamp is ideal, but the weld must be a good heavy job.

If the battery is fitted with screwed terminal posts as in traction batteries and crane batteries of the nickel-iron type, the switch is fixed directly on to the pillar by the terminal nut. This gives a good electrical contact.

Some device must be fitted to the machine for bringing the electrodes together, and the simplest is a coil spring between the arms. This must, of course, be insulated from the top arm, and if a spring is fitted a means for opening the contact is required.

The more convenient way of doing this is to fit a spring to keep the arms open and to close them to suit your own needs. This is done by using a Bowden cable and foot pedal (Fig. 4). A length of Bowden cable such as used on cycles is ideal.

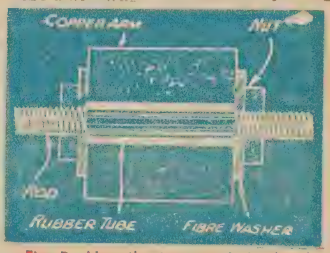


Fig. 5 How the top arm is insulated from the supporting rod.

The method of connecting up is very simple. First make a small arm about 1in long and fix this on the upper electrode arm supporting rod, using lock nuts, etc. The arm is made from sheet brass and is soldered or brazed to a nut to screw on the rod.

The arm must not turn on the rod, and it has to be well made and quite strong as considerable pressure can be brought on it by the foot pedal.

A small catch is fixed on the lower

(Continued on Page 94)

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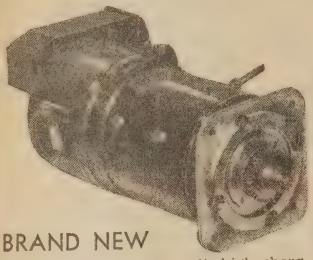

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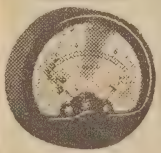

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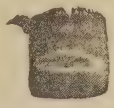

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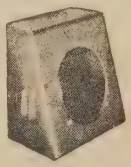
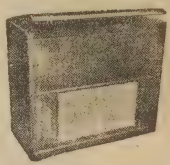
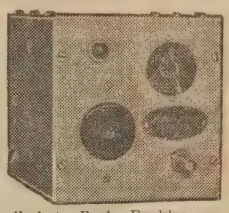


Streamlined Steel Speaker Boxes. As illustrated with brown crackle finish. Suitable for speakers up to 8". Price, **36/6.**



Radio Cabinets. Beautiful walnut piano finish, standard model, **£13/19/6.** Model with deep well for record changer, **£14/7/-.** Also available in blonde finish. Standard model, **£16/9/6.** Model with deep well for record changer, **£16/17/-.** Country and Interstate clients add 15/- packing charge.

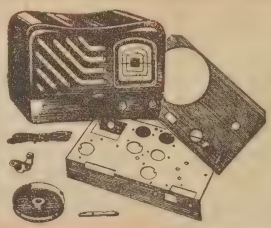


Jewell Auto Pack. Enables you to use your ordinary AC Mantel Radio in your car. 6 or 12 volt models, complete with instructions, **9 Gns.**

Microphone Insert. Acos Crystal Microphone Insert. Suitable for D 104 Microphones. Price, **28/2.**

Pickup Bargain. English Shefi High Fidelity Moving Coil Pickups. Complete with matching transformer. Reduced from £4/19/- to **29/11** as illustrated.

"Bargain" Dual Speed Gramo. Motor. The new Goldring Synchronous Gramo. Motor. 78 and 33 1-3 rpm. Ideal for micro-gram, etc. Only **£5.**



Bakelite - Cabinet, Steel Chassis, Baffle Plate and Dial Assembly. Bargain for the set builder. Complete, as illustrated. Price, only **45/-.**

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THE NEW BA1 HIGH FIDELITY CRYSTAL PICKUP HEADS. Suitable to replace all Collaro or Garrard magnetic pickups. When ordering, advise if required for Garrard or Collaro pickups. Price, **49/6.**

DISPOSAL VALVE BARGAINS!!

Type EF50 High Gain RF Pentode 6.3v. 9-pin lock-in socket 15/-
Type EA50 6.3v. VHF Diode, suitable for the Vacuum Tube Voltmeter Test Probes .. 15/-
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Type 807 Beam Power Amplifier 15/6
Type 100TH 100 Watt Triode 49/6
Type S.T.V. 280/80 Type Multi Circuit Voltage Regulator 14/-
Type 42 S.P.T. 4v. Cossor Screened Pentode .. 13/-
Type 5BPI 6.3v. Cathode Ray, 5" screen, elect. deflection 37/6

(Plus Sales Tax)

Type 7C7 Triple Grid 6.3v. 8-pin Lock-in 15/-
Type 2X2 High Vacuum Rectifier 4-pin 15/6
Type 834 7.5v. 4-pin Power Amplifier 29/3
Type 6SH7 Sharp Cut-Off RF Pentode 15/-
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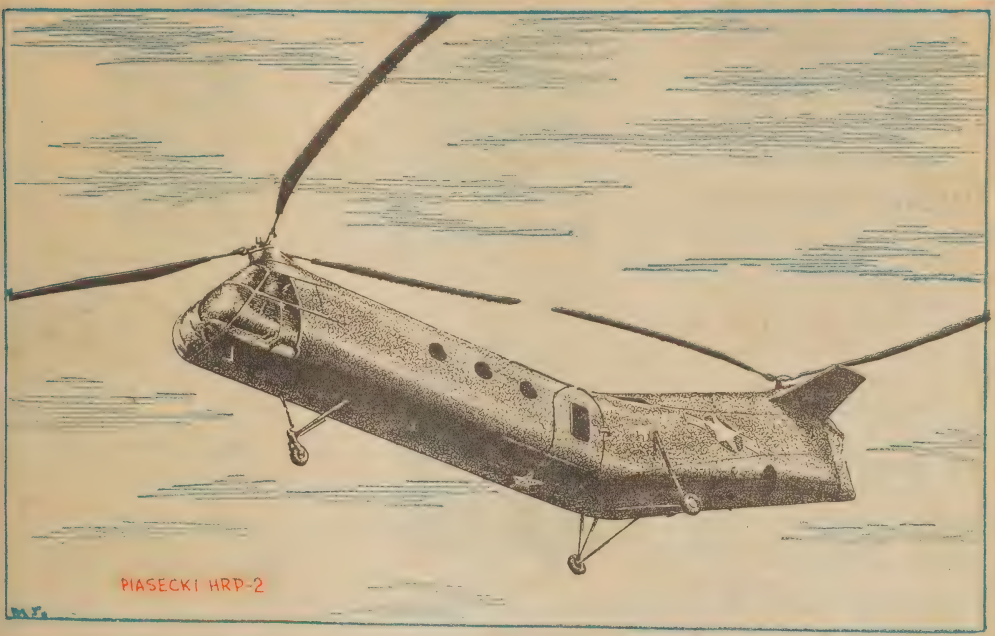
Type RL18 6.3v. Rigid Wire Base VHF Triode .. 13/-

10% Discount to Licensed Amateurs

290 LONSDALE STREET, MELBOURNE. Central 4311

NEW HELICOPTER FOR U.S. NAVY



Developed for the US Navy, the all-metal Piasecki HRP-2 is a multi-purpose transport helicopter of interesting design. It is of particular value for use in rescue work from the sea or from areas that defy more orthodox rescue operations.

BUILT by the Piasecki Helicopter Corporation, of Morton, Pennsylvania, the HRP-2 is an adaptation of the first successful tandem rotor craft to be put into production.

The Piasecki firm had its origin in 1940 when a discussion group of several engineers interested in the development of rotary-wing aircraft was formed. Later, the P-V engineering firm was formed and it received and successfully carried through a number of contracts relating to rotary-wing developments for the US National Advisory Committee for Aeronautics.

IMPORTANT CONTRACT

In February, 1944, the organisation was awarded the contract by the US Navy for the development and construction of a large tandem-rotor transport helicopter. The prototype was flown successfully in March, 1945. In the following year the firm's name was changed to Piasecki Helicopter Corporation.

The first production of the tandem-rotor helicopter, the HRP-1, was completed in August, 1947, and the HRP-1 is now in service with the US Marine Corps and Coast Guard as well as the US Navy.

In mid-1948 a limited production contract was let for an improved all-metal version of the HRP-1 with slight modifications. This is the machine known as the HRP-2, sketched here.

Powered by a 600-horsepower Pratt and Whitney R-1340 Wasp air-cooled radial engine, the HRP-2 carries a crew of two, accommodated side-by-side in the nose section with dual flight controls.

The fuselage has an overall length of 54ft and a clear and unobstructed cabin 20ft long, 5ft 6in. high and 5ft 6in wide. The cabin can take up to 12 stretchers or, in an emergency, as many as 27 men.

The rotors are mounted at the extreme ends of the fuselage, making possible a wide variation of load without affecting balance. It is possible to trim the aircraft for almost any flight condition with almost any load up to the maximum.

The rotors are 41ft in diameter. Empty weight of the machine is 5054lb, and loaded weight 6978lb.

A modified version of the HRP-2 has been ordered by the US Air Force for Arctic rescue work. The machine, designated H-21, will be fitted with the high-powered Wright R-1820-76A engine and "omniphibious" landing gear that will permit landings on snow, ice, water, tundra, marsh or land.

The H-21 will have rotors of slightly larger diameter—44ft.

This machine will be equipped with a swinging hydraulic hoist above a large sliding door immediately behind the pilot and a further door placed toward the rear of the fuselage on the other side for loading and unloading on the ground.

A READER BUILT IT

(Continued from Page 69)

shown in the circuit.

The coupling of the first RF valve to the next stage can be made via the standard Reinartz coil primary although under normal circumstances an "RF coil with reaction" would be used in view of the higher impedance of the primary winding.

The regeneration control of the 1K7-G could act as a volume control also but, if need be, the 0.5 megohm grid resistor of the 1L5-G could be replaced by a potentiometer with the moving arm going to the grid of the valve.

Our contributor is quite keen about the performance of this set. He says that from his location he can log 11 stations in daylight including 2UW Sydney in the middle of the day. At night he has experienced interference from New Zealand.

AMATEURS—DISPOSALS—EXPERIMENTERS

MIDGET GENEMOTORS

Input: 28 volts at 1.1 amps.
Output: 250 volts at .06 amps.
Size: 4½ x 2¾. Weighs only 3 1-8lb.
Perfect for use with 32 volt domestic receivers.

32/6

Postage and Packing 3/-

GENEMOTORS (9 VOLT)

A Genemotor that will operate efficiently on 6 volts. Made to operate on 9 volts, these Genemotors have an output of 230 volts at 60 m.a. when operated on 6 volts. Perfect for use with portable amplifiers etc.

50/-

Postage and Packing 3/6 extra.

MOTORS

Genemotors with protruding Shafts at each end which with slight alteration will operate on 240 volts A.C. Excellent for Workshop Fans, etc. Conversion Sheet supplied with each motor, conversion takes only 15 minutes.

37/6

Postage and Packing 3/6 extra.

GEAR BOXES

Gear Boxes with 3 protruding Shafts, Ratios approx. 1000, 200 and 40 to 1.
Attaches to motor as advertised above.

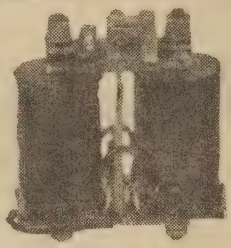
7/6

Postage and Packing 2/- extra.

RELAYS

Rotary type using a standard oak switch bank. Can be connected to extra banks for band switching, etc.

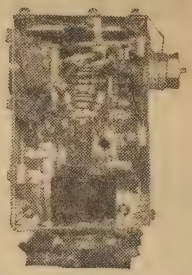
10/6 Postage 2/-



RELAYS

Twin Coil type, can be adjusted to work on as low as 1 m.a.; extra coil is for use in locking if required.

4/6 Post Free



H.F. OSCILLATORS

Complete with 7193 valve, ready for use. Tuned by a split stator condenser worth this amount alone. An excellent driver for your 144 m/c. Transmitter. Alternatively, modulate the unit as it stands.

15/- Post Free

TELEPHONES

D.V. type. New in Cartons. Complete with Handset.

70/- F.O.R.

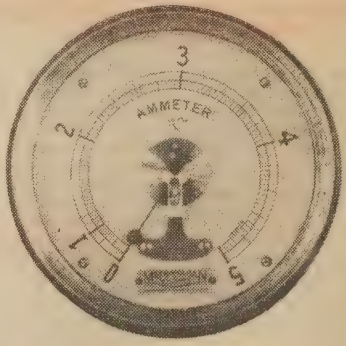
TELEPHONE CABLE

American type, plastic covered in ½-mile rolls. Perfect for use with the above phones.

50/- F.O.R.

37/6

F.O.R.



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F.O.R.

A.C. AMP. METERS

A.C. Amp. Meters (ex County Council). A necessity in any electrical workshop.
RANGE. 0-5 amps. (can be extended by shunts).
MOVEMENT. 300 degrees.
SCALE LENGTH. Nearly 15 inches.
DIAMETER. 7½ inches.
Available in either Metropolitan Vickers or Ferranti.

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MAKING YOUR OWN PRINTS

No elaborate equipment is necessary to make your own prints and a satisfactory "dark-room" can easily be improvised. This article describes the simple procedures and tests which allow you ultimately to produce any number of uniform prints.

By PHILIP WATSON

YOUR efforts so far have produced what is called a negative. Strictly speaking, this in itself is a photograph of the scene you "snapped," but it is not very satisfactory from an artistic point of view.

The glamorous brunette you photographed while on holidays would not be very flattered with a picture showing her as having white hair and black face. In other words, the tones of a negative are reversed, hence the name.

But even if the tones of the negative were corrected there would be another difficulty. It's the only one of its kind in existence, and if you give it to the brunette you are left without a copy for yourself.

The object of making prints, therefore, is twofold — to reverse the tones into their correct order and to make available as many duplicates as may be required.

How is this done? Simply by taking another "photograph," this time of the negative. As you would imagine, the process will follow along very similar lines to those you used to make the negative. A photographic emulsion is used, similar to that on the film, but coated on paper instead of celluloid.

GENERAL PRINCIPLES

In use, this emulsion is exposed to the negative image and then developed and fixed in a similar manner to that used for the negative. The result is a print with all the tones in the right order, and you may repeat the process as often as you like.

Although the photographing of a negative may sound complicated, it is really quite a simple process. No camera need be involved, the negative being simply placed in contact with printing paper and the combination exposed to light. Thus we get the term "contact" printing.

That is the general picture. Now to get down to details.

You will need a packet of printing papers, a printing frame and preferably a packet of printing masks. All these, of course, must be of the correct size to suit your negatives. Also, if you have not already bought it, you will need the yellow safelight mentioned in last month's article.

The paper is often called "gaslight paper," a relic of the days when this type was first introduced. It has a slow emulsion, compared with film, but is still sensitive enough to be exposed by artificial light.

GRADES OF PAPER

A number of grades or contrasts are available, ranging from a No. 1, having a low contrast, to a No. 4, with a high contrast. For a start get a packet of No. 2, as this is designed to suit the average negative. The correct use of the other grades will be explained when you have had a little more practice.

Different surfaces, such as rough, matt, glossy, &c., may be chosen, but the glossy is by far the most popular for small contact prints. The rougher surfaces are suitable for large prints, but tend to mask some of the fine detail in the smaller sizes.

The chemicals required will be much the same as those used in developing the film. In fact, if you used one of the general purpose developers for your film it may be used for your papers also. In some cases the degree of dilution will vary, however, and the maker's instructions should be checked.

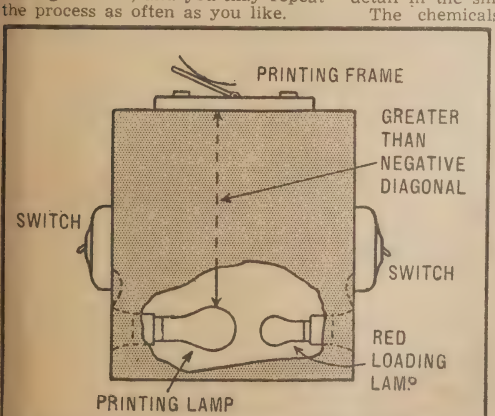
The fixing bath will be the same, and you may also provide the water rinse, although it is not as important as in the case of films. Some workers prefer to wet the surface of the print before putting it in the developer, mainly to minimise the risk of air bubbles, which will leave undeveloped spots on the finished print.

LOADING THE FRAME

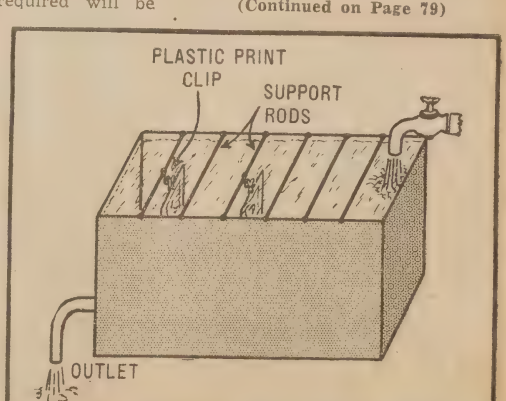
Next thing is to load the printing frame and make the exposure. Place the frame face down on the bench and open the back. Lay the negative on the glass with the emulsion (dull) side up. Open the packet of papers, by safelight, of course, and take out one sheet. Make sure that the remaining papers are properly wrapped again before doing anything else. Otherwise it is very easy to ruin a complete packet. The paper is placed emulsion (glossy) side down on the negative and the back of the frame replaced and locked.

Correct exposure can only be determined by experiment, as there are a number of factors effecting it, such as strength of light, distance from light, sensitivity of the particular make and grade of paper, and, finally, the density of the negative.

(Continued on Page 79)



You can ensure constant exposure light by making a printing box as shown. It is also much more convenient and the red lamp is a considerable help when loading.



This simple tank will make washing easy, and ensure that each print will receive an adequate flow of water over it. Additional details are given in the text.

HEADPHONES

Brand new. Low Impedance headphones in boxes. Well known brand. Very robust construction, suitable for use on any radio, etc.

Excellent value at 15/-.

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U.S. Army, full wave I.M.A. rectifiers—will work successfully on 5mA. Extremely small physical size—brand new. Easily worth 35/-.

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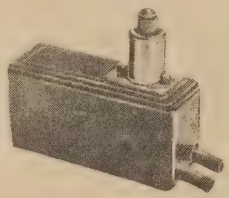

MICRO SWITCHES

As illustrated, in perfect condition, makes 2 circuits breaks one, usual price 15/-.

Our price 5/6.

SOLDERING IRONS

Job line of 6 volt soldering irons. Only 17 watts of power required. Operates off radio receiver, power transformer, car battery or any other 6 volt supply. Beautifully finished in Chrome or black. Patent rest prevents bits from touching bench when not in operation.

Usual price 38/-.

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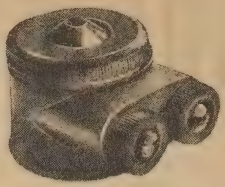

INDICATOR LAMPS

These handy little lamps can be used for indicators on panels, tail lamps of caravans, trailers, bikes, side lights on trucks, cars, etc. An ordinary 2.5, 3.8, or 6.3 globe can be fitted into the socket and lamp is easily fitted by means of wood screws, or machine screws. Available with Red or White glass, easily worth 5/- each.

Our price 2/- each.

With globe 2/6 each.

KINGSLEY VOLTAGE DIVIDERS

Brand new and in perfect condition, available in 15,000 and 25,000 ohm sizes. Usual price 5/6.

Our price 2/9.

RHEOSTATS

Bargains in Heavy Duty Rheostats! I.R.C. 250 ohm 25 watt wound on Mica and porcelain insulated as illustrated.

Price 4/6.

100 ohm. Heavy Duty Rheostat as used in English Aircraft.

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NOTICE

All parcels will be sent registered post unless otherwise stated. Postage or Freight must be included with order.

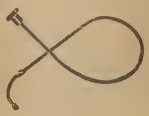
BRITISH NAVY CARBON RESISTORS

Assorted bundles, all wattages and values mixed ¼ watt, 1 watt, 2 watt, 5 watt, from 10 ohms to ½ meg. 5% and 10% accurate. An excellent buy. While they last. Priced as follows:—

50 assorted 15/-

100 assorted 27/6

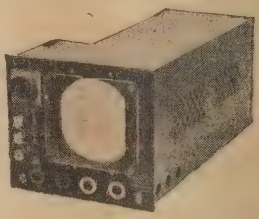
500 assorted £6/5/-



REMOTE CABLES

As used on 108 Transceivers, an excellent control that can be used on car radios, etc.

Price with knob, 1/- each.



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This is an ideal unit to be converted to an oscilloscope or stripped for the excellent parts valves, etc.

Parts are:—

1. 5. B.P.1. Valve complete with socket and nu-metal shield.
6. 6 A.C.7 (1852) valves.
3. 6H6 Valves.
12. Potentiometers.
10. Block Condensers.
40. 1 Watt. I.R.C. Resistors.
1. 3 position 2 bank switch.
1. Toggle Switch.

All enclosed in neat metal case. Easily worth £25.

Our price £8/10/-.

MOTOR SPARES LTD.

547 ELIZABETH ST. MELBOURNE

Making Your Own Prints

(Continued from Page 77)

With the exception of the last one, it should be possible to standardise these factors, and the beginner is strongly urged to arrange fixed positions for printing light and frame and to stick to the one make of paper.

This only leaves the negative density to be judged, and with a little practice this becomes fairly easy. Later we will detail how this also may be to some extent standardised.

As a rough guide, we make the following exposure suggestion. With the frame at one foot from a 60-watt lamp, exposure time should be between 5 and 30 seconds, depending on negative density. To avoid wasting paper, the first sheet may be made to carry several exposures.

TEST EXPOSURES

First, expose the whole of the sheet for 5 seconds, turn off the light and cover about a quarter of the frame with a piece of card. Expose for a further 5 seconds and then cover another quarter of the frame. Follow with exposures of 10 and 20 seconds in the same manner. The print will now have been exposed in four strips for periods of 5, 10, 20 and 40 seconds, and upon development it will be easy to pick the best exposure.

After exposure, place the print in the water bath for about half a minute, then shake off excess water and immerse in the developer, checking the timer as you do so. Be sure to rock the dish gently until development is complete. This is to ensure that fresh developer is continually brought into contact with the emulsion, replacing that exhausted by chemical action.

Unless otherwise specified by the makers, fresh developer should completely develop the image in 45 seconds at 68 degrees. For your test strip adhere exactly to these figures, without regard to the appearance of the print.

At the end of the 45 seconds transfer immediately to the acid fixing bath, and move the print around in the solution for the first few seconds. If this is not done, yellow stains may result. Your test strip may be safely removed and examined by white light after a minute or two. Regular prints should be given about ten minutes in the fixing bath.

EXPOSURE ERRORS

Having chosen a suitable exposure time from the test strip, reload the printing frame and give the print this exposure. Repeat the development procedure exactly as you did for the test strip, and the print will be identical with the section chosen. If all sections of the test are either too light or too dark, you will need to make another test. Either select a new set of exposure times or alter the distance between the frame and the light. Remember that, if you double the distance to the light, you will have to give four times the exposure to get the same result. If the light is too close, uneven lighting may result. Do not use a distance less than the diagonal of the negative.

When you have made a satisfactory print, the negative may be used as a standard from which to judge the exposure for the remaining negatives. In this case, a little variation in development time will be permissible, but the best results will be obtained when the correct print density is achieved in the correct development time.

Over-exposure will cause the image to flash up and quickly darken all over. Any attempt to save the situation by terminating development is hopeless. Such a print will be dark and lacking in contrast. It will probably have a greenish tinge, with the mottled appearance of uneven development.

Under-exposure will result in a print which is too light, and with detail missing in the highlights. Attempts to force density into such a print is useless, and will only result in the yellow stains of over-development.

A very worthwhile aid to judging print exposures is a set of standard negatives. These are made by taking several shots on the same roll of film, of the same subject, but having different exposures. First estimate the normal exposure for the prevailing light, &c., and give a quarter of this for your first shot. Follow this with exposures of half, normal, double, and four times normal.

When developed, take some care in making the best possible print from each negative, being careful to record the exposure time and grade of paper used. If possible, make these prints without cutting the film strip into individual negatives.

TEMPERATURE EFFECTS

Any negative to be printed is now compared with the standard negatives until one is found which most nearly matches it. By this means, reasonably accurate printing exposures may be judged with comparative ease.

The subject used for these negatives should be a fairly average one, including if possible a figure, sky, foliage, and shadows.

If your camera is one of the simpler types, a large range of exposures may not be easy to arrange. In this case, the same subject may be taken under different lighting conditions, such as bright sunlight, misty, and dull. Although it may take longer, it should be possible to produce a suitable batch of negatives.

Variations of temperature will cause variations of development times in just the same way as it does with film. Once again, it is impossible to give exact details, since so much depends on the developer being used. However, approximate figures would be 30 seconds at 75 degrees, 45 seconds at 68 degrees, and 60 seconds at 60 degrees.

These figures are only intended as a guide, since other factors, such as developer exhaustion, must be taken into account.

Temperatures below 60 degrees sometimes give unreliable results, and it may be better to warm the solution slightly.

The best way to do this is to place

(Continued on Page 96)

LUCKY PURCHASE BRAND NEW ENGLISH ARMY SPOTLIGHTS

Ideal for Shooting, Fishing, etc. Fit one to your Car 29/6

Complete in Case, with Red, Amber and Green Discs.

JUST ARRIVED! BRAND NEW Air Force Type. Blue Berets

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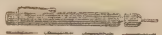
Ideal for Engineers, Mechanics, Hobbyists. 5/9



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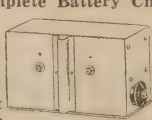
Fitted with brand new English Selenium Rectifier



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6v 2 amp .. 24/6
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Transformers to suit above Rectifiers, 2 and 5 amp, 65-volt .. 37/6

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English 150 amp A.C.-D.C. meters, 3½" dia. Ideal for generators. 57/6.

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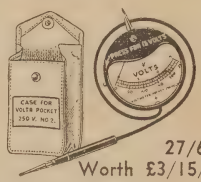

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2.2 cubic feet, will pump up to 75lb.

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Altimeter or Height Meter. Lots of interest. Fit one to your car 30/-

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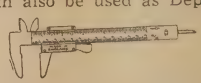
Will measure inside and outside. Can also be used as Depth Gauge.



22/6

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RAAF AIRPLANE COMPRESSOR
Two Stage
Limited Numbers
Highest Quality
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American style expanding Wristlet Watch Bands, Chrome plated, 9/6. Gold 16/6

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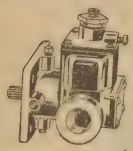

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400 gals. per hour 55/-

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24 volt 1500 watt £13/15/-
Brand New English Lucas, 12 or 24 volt 500 watt £10/15/-

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Fraction of New Price

5½	x 5½	5/-	per	pkt	144
8½	x 6½	12/6	"	"	"
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Can be used as Low Pressure Compressors or for Low Pressure Spray Guns, Brazing.

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Limited Quantity available.

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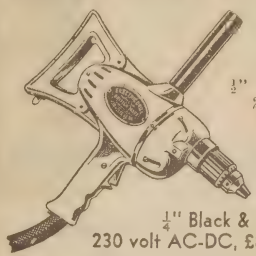

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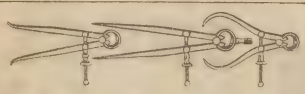

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Develops up to 120lbs. per square in. of hydraulic pressure, will pump 7½ gals. S.A.E. oil or other liquids per minute. Useful for spraying, milking, presses, oil burners, hydraulic systems £3/15/-

Perspex Sheet takes the place of glass. Ideal for car windows.

24	x 18	3/32"	£1/12/6
22	x 14	3/16"	£1/1/-
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Telephone FJ5904

INCLUDE STATE IN ADDRESS

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Brand New Army Boots, Size 9 only. Pair	26/6
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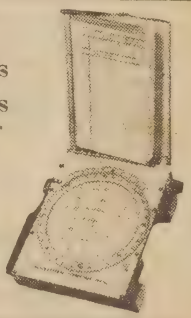
AT LAST:

DALTON COMPUTORS IDEAL FOR AERO CLUBS A.T.C., ETC.



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Made in England. Brand New.

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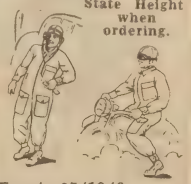

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100 REVS. PER MINUTE VERY USEFUL. WORKS OFF 32 VOLT LIGHTING PLANTS.

£2/2/-, cost £6/15/-

DISPOSAL BARGAINS

RADIO BENDIX MN.26.C COMPASS RECEIVERS

Huge Purchase, 300 Brand New in Original Cases

THE LAST OF THESE RECEIVERS THAT COST £286/-/-

The saving in cost on this purchase passed on to YOU. This is the finest broadcast receiver ever offered. 12 valve. Operates from 24V. Converts easily to 240V-AC also 6V, 12V or 32V.

COMPLETE WITH 12 VALVES and CONVERSION CIRCUIT

£15/17/6

LESS MOTORS £14/5/-
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Completely converted, including Speaker, Dial and Control Panel, fitted, tested and Dial calibrated ready for use.

6V. D.C. Operation .. £25/17/6
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THE CONVERTED RECEIVER

with 55 to 1 ratio dial. 8" speaker in bakelite cabinet.

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Chassis fitted for S/W Converter.

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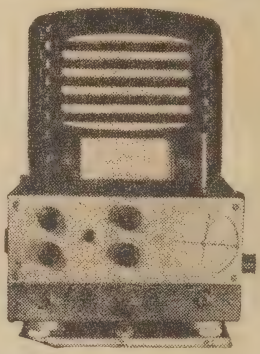
THE MOST SENSITIVE SET AVAILABLE IRRESPECTIVE OF PRICE.



CONTROLS:
Volume, Sensitivity B.F.O. Tone & Tuning Wave Change Switch

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DIRECT RECEPTION of Europe, USA, and Asia on the Broadcast Band.

VALVES USED 2 6J5 2 6N7 1 6F6 1 6B8 1 6L7 5 6K7 IF FREQUENCY 112KC.

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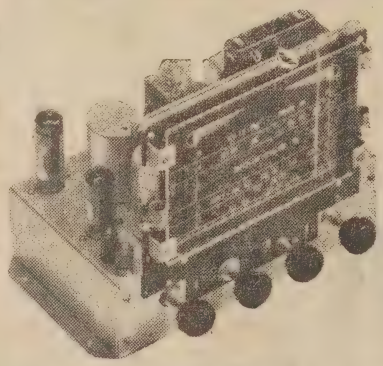

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The Kit complete to the last nut and bolt, including valves and 8" speaker.

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and a further special for purchasers of this kit. A tablegram cabinet to suit and Collaro Gramo unit with crystal pickup at less than cost. **£9/12/6**

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Dualwave version, including 12" speaker. **£16/15/0**

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Complete kit including 12" speaker. **£13/17/6**

The 5 valve version with R.F. stage and 12" speaker. **£15/12/6**

EXCELAIR RADIO

136 VICTOIA RD. MARRICKVILLE. N.S.W.

A SUPERHET RECEIVER FOR 144 Mc.

(Continued from Page 31)

modulated oscillators still in use on this band.

In our case, the I.F. channel was built largely around parts retrieved from Air Ministry type 1133 or 1143 equipment. Most important items are the four 9.7 Mc. I.F. transformers, which are just about ideal for this type of set.

Actually the 9.7 Mc. frequency is too close for comfort to the 31 meter broadcast band and it is worthwhile to push the adjustments as high in frequency as possible. You should be able to get them up to 10 Mc. odd before getting outside the tuning range of the slugs.

OTHER TRANSFORMERS

Standard 10.7 Mc. transformers, as sold for F.M. receivers, would be better still but the loading resistors would have to be removed to sharpen up the response.

You will find that some of the 9.7 Mc. transformers from disposals equipment also have built-in shunt resistors and it is desirable to remove them before the transformers are installed. In our case, we found the resistors so neatly tucked away that it would have been a major and rather dangerous task to unsweat and remove them in the approved fashion. Rather than endanger the windings, we simply crushed the resistors with a pair of pointed pliers, breaking them away from the pigtails and cutting the latter short afterwards.

If the loading resistors are not removed, the I.F. channel will be unnecessarily broad and the gain will suffer.

The 6N8 valves in the I.F. stages have a nominal transconductance of just over 2000 and the I.F. gain is about right. Other valves having the same general figure of Gm. could obviously be substituted with equivalent results. With the 6U7-G and EK7-G the gain would definitely be in the low side, while higher slope types like the 6BA6 would need to be biased back in most cases to preserve stability.

F GAIN

There is nothing very critical about this and the average amateur, knowing the general position, should not have any difficulty in making suitable arrangements to use the parts on hand.

The chassis measures 13" x 8 x 2½" and it should be possible, by careful planning, to maintain these general dimensions even with larger valves in the I.F. channel. In this connection, some of the octal sockets from American I.F.F. sets are particularly compact. They were used, in this case, for the audio and rectifier valves. The panel size is 14" x 8".

It will be noted from the circuit that decoupling has been freely used in the I.F. channel, being included as a matter of course. Most amateurs have collected plenty of oddment mica condensers and resistors and these are ideal for the purpose. The exact values are not critical.

If you want to save a few components, it would be quite permissible to wire the channel with a minimum of decoupling and add the components later as they are found necessary. Incidentally, it is usually unimportant whether the screen feed resistor comes off the decoupled point or the B-plus line. Even though it is shown one way in the circuit, it can be wired whichever way is physically the most convenient.

We tossed up for a while about the type of detector, being tempted to wire in a Foster-Seeley discriminator which would handle both F.M. and A.M., if used without limiter stages. It may ultimately be installed but, in the meantime, a standard noise limiting detector was provided, which has its own special advantages. Stations using F.M. can still be received by slope detection.

HEATER CIRCUIT

One interesting point about the noise limiter is worthy of mention. The heater was wired at first to one side of the total 12.6 volt supply but the hum was far too high to be pleasant. To correct the condition and give a balanced heater circuit, it was wired across the 12.6 volt supply with a 20 ohm resistor in series with each lead. This afforded a balance with respect to earth and reduced the heater voltage at the same time, completely obviating hum trouble.

The audio end was determined in detail by the old amateur trick of using up oddment parts—hence the 12.6 volt heater circuit and the 12SL7/12A6 combination. They could be replaced quite well by any other suitable tubes which might happen to be available.

The back-bias resistor gives just over 20 volts of bias for the output valve, which is high but not excessive for ordinary amateur work. The same bias, operating on the three I.F. stages, gives plenty of manual control over the gain.

THE B.F.O.

The unused half of the 12SL7 has been wired as a beat oscillator. On 144 Mc. the B.F.O. is not a very important item, since M.C.W. is used much more frequently than C.W., where Morse transmission is employed. Furthermore, the extremely high frequencies involved show up the usual B.F.O. system rather badly from the point of view of frequency stability. Its main use may well be as an aid to locating weak carriers.

The B.F.O. coil has 11½ turns of 24 B & S enamel tapped at 3½ from the earthed end. It is wound on a ¾" diameter former, grooved 16 T.P.I. and tuned by a 100 pf. mica condenser and a 30 pf. variable air trimmer.

The power supply is quite standard and the photographs give all the necessary information about layout.

It is not proposed to specify a special chassis for this receiver as most amateurs will want to vary the layout details to suit themselves.

SHORT WAVE NOTES BY RAY SIMPSON

INDONESIA OPENS NEW STATIONS

In a recent letter to Art Cushen, Mr. M. P. Breedveld of Radio Republic Indonesia gave some interesting details of new stations which have recently taken the air and also some frequency changes to other of their stations. Many recent improvements have taken place in this country's broadcasting activities, especially on the short wave bands.

HERE are the details of the stations mentioned in Mr. Breedveld's letter. YDL2 on 2.32 mc is a new 300 watt station located in Padang, Sumatra; YDN 2.39 mc has moved from 8.91 mc to give better coverage to northern Sumatra.

This station, which is located in Kutaradja, usually relays the programmes from Djakarta; YDI3 2.467 mc Soerabaja has moved to this frequency from 7.295 mc; YDI6 is the call allotted to the Kediri, Java, station, which operates on 2.5 mc; YDP2, in Medan, Sumatra, has changed frequency from 7.36 mc to 3.32 mc and carries the second regional programme; YDM on 3.27 mc has moved here and is now using 300 watts.

A new station has been opened in Banjermasin, Borneo, using the call letters YDO. This station came on the air on 1st June, 1950, and is another one to use 300 watts.

The well-known Bandoeng station, YDA, now has line connection with Djakarta and becomes one of a small network covering Indonesia with a second Archipelago programme from Djakarta. Others in this network are YDB2 7.27 mc beamed on Sumatra, YDE 11.77 mc beamed on East Indonesia, and YDD on 2.6 mc directed to Djakarta.

YDI4, which used to be in Soerabaja, has now been moved to the famous island of Bali and operates on 4.84 mc from Denpasar. The Djakarta station YDD2, which used to operate on 4.865 mc, was closed down on 1st December, 1950, and it is said the old frequency will be used by a new transmitter.

There is to be a new Home Network opened soon in central Java and the key station will be YDJ2 on 7.1 mc, which is located in Jogjakarta and which has a power of 1 kw.

Other stations in this city are YDJ2, 5.06 mc, 1kw, and YDJ3, 2.45 mc, 300 watts. YDL, in Padang, has temporarily moved from 3.27 mc to 7.24 mc, while YDQ3, the well-known Makassar station, has taken over 7.295 mc in place of their old channel of 11.08 mc, as this latter frequency is outside the new broadcast bands.

We are indebted to the NZ DX Times for the above information, which we know will be of interest to many listeners.

Recent Verifications

HROW HONDURAS.—Not many verifications are received from this little-known Central American republic, and it was therefore very pleasing to receive a very nice verification letter from HROW Radio Monserrat, confirming reception on 6.02 mc.

The letter is in Spanish and their letterhead is in green, showing a view of the countryside, with large call letters at the right-hand side. They list the complete programme reported on and sent their reply by air mail, signed by manager Alfredo Leon Gomez. We note they also list a frequency of 6.675 mc, in addition to 6.02 mc, and broadcast band outlet on 850kc. Address is Parque Finlay, Tegucigalpa, Honduras. This should be a good bet for anyone who has not yet verified Honduras.

OLR5B CZECHOSLOVAKIA.—Although verifications from the Czechoslovakian stations have been received for many years, we list the latest one received from them, confirming reception of OLR5B on 15.32 mc, as the writer of the letter, Vladimir Tosek, went to a great deal of trouble to explain why they had not answered a report sent to them in June 1948.

They checked their records, but were unable to confirm their transmission, as their North American short wave service could not confirm the report, not being in English. They are very anxious for further reports, criticisms or suggestions for improving their programmes, so further letters should bring results, we think.

LRA ARGENTINA.—The State Radio in Buenos Aires, which operates station LRA on 9.69 mc, are still sending out their old verification card, which was used quite a number of years ago. This card is quite an attractive one and has the call letters in light blue, with an embossed crest in the top left-hand corner.

This station is operated by Direccion General de Correos y Telegrafos Estacion de Radiofusion del Estado, which, in other words, is the Director-General of Posts and Telegraphs of the State broadcasting station. It is well worth sending for and is a change from the SRI type of verification from LRY.

PRA8 BRAZIL.—Another South American card has been received from PRA8 in Pernambuco, Brazil, confirming reception of their signals on 6.01 mc. The card is printed in blue and shows the station antenna masts at the left, with a few bars of music superimposed on the design. At the right are the call letters, station address, &c., while on the reverse side they give further information printed in Portuguese, English and Spanish.

They are anxious for further reports and for those who are interested the address is Radio Clube de Pernambuco S.A., A. Cruz Cabuga 394, Pernambuco, Brazil. Their broadcast band outlet is on 720 kc.

CR8AA PORTUGUESE INDIA.—After rather a long delay, the station authorities at Goa have sent a nice letter confirming reception of their station, which operates on 9.61 mc. According to the letter, they are on the air from 11.30 a to 3.30 am, and also state that a new 10 k station will shortly be on the air, b no mention is made as to what frequencies will be used.

If readers remember, this station use to be heard on 7.23 mc, but has appa ently discontinued use of this channe The station is operated by Reparticao Ce tral dos Services dos Correios, Telegraf e Telefones do Estado da India. imagine this will be a new country f some of our younger listeners.

BCOF JAPAN.—This station has no been on the air for quite a long tir and was formerly known as WLKS, b the call has now been changed to BCO which of course is really British Co monwealth Occupation Forces. Their ca is a new one, printed in white and r and it is signed by Captain F. A. Coll They operate on 6.105 mc, with a pow of 1000 watts, from 8.30 am to 11.30 p and on a favorable night can easily logged in Eastern Australia. They al have a broadcast band outlet on 1470 k

GREENLAND is a country which as f as we know has not yet been logged Australia, as the only channel we ha heard of was "Gronlands Radio" on 5 mc, which is on the air at the rather u satisfactory time of 8 am. According the latest issue of Sweden Calling DX there is a station which is thought to in Greenland operating on 7.56 mc a also on 12.3 mc from around 11.30 p to 12.45 am.

SHORT-WAVE LISTENER CLUBS

FROM time to time we have received inquiries from Australian listeners as to what overseas short wave clubs are in operation and as a help to these listeners we give details of those we know to be in active operation.

NEW ZEALAND RADIO DX LEAGUE

This league has its headquarters in Dunedin and the annual subscription is 9/-, which entitles members to a copy of their monthly magazine, The New Zealand DX Times. They also conduct competitions to cover all sections of DXing, with attractive certificates and trophies awarded to section winners. Address is, The Secretary, NZ DX League, 15 Plunket Street, Dunedin, New Zealand.

UNIVERSAL RADIO DX CLUB

This is one of the best known American clubs and has now been in operation for 17 years under the very able leadership of Mr. Charlie Norton. They publish a very interesting magazine called the Universalite, which readers will have seen mentioned quite often in these pages. There are 19 issues of this magazine each year and it caters for both the short wave listener to the commercial sw stations and also those who prefer to listen to the amateur stations. This latter section very often gives the addresses of many infrequently heard stations. Subscription is 3.00dol. per annum and should be sent to Universal Radio Club, 29201 Dixon Street, Hayward, Calif., USA.

STATION ADDRESSES

LRA: Radio del Estado, Palacia de Correos y Telecommunicaciones Ayacucho 1586, Buenos Aires, Argentina.

ZYU8: Radio Difusora de Teresina, Ltda., Rua Areolino de Abreu 1157, Teresina Est. Piaui, Brazil.

CP5: Radio Illimani, Casilla 637, La Paz, Bolivia.

HJGB: Radio Santander, Apartado 37, Bucamaranga, Colombia.

OAX4J: Radio Colonial, Apartado 1166, Lima, Peru.

TIEP: La Voz del Tropico, Apartado 257, San Jose, Costa Rica.

HI1Z: Broadcasting National, "La Voz de los Muchahos," Apartado 1092, Ciudad Trujillo, Dominican Republic.

FG8HA: Chef Service Information, Directeur de la Radio, Palais d'Orleans, Basse-Terre, Guadeloupe.

TGDA: La Voz de Occidente, Independencia 8, Quezaltenango, Guatemala.

XEHH: Sal de Uvas Picot, Zempoa 77, Mexico City, Mexico.

NOUMEA: Radio Noumea, La Voix de la France dans le Pacifique, Service de l'Information, Noumea, New Caledonia.

DZH2: Manila Broadcasting Co., 7th Floor, Insular Life Building, Manila, Philippines.

YDH2: Radio Indonesia, Studio Semerang, Dr. de Vogelweg 1, Semerang, Indonesia.

TUNIS: Radio Tunis, 2 Rue d'Alger, Tunis, Tunisia.

CR6RM: Radio Clube de Mocam Mocamedes, Angola.

SHORT Wave Notes for the March issue are due on February 5 For the April issue they are due on March 12. Please send them direct to Mr. Ray Simpson, 80, Wilga Street, Concord West, N.S.W.

The Voice of America and the A.F.R.S.

IN last month's issue we stated that we would try to give a complete summary of the American stations this time, but owing to this issue going to press earlier than we anticipated we have not been able to compile a complete list but will only touch on those stations which we have noted during the past few weeks.

Judging by the new outlets we have noticed it seems that practically any of the American stations is likely to appear on any one of the many frequencies allotted to the USA, and in addition they occasionally pop up on entirely new ones. This will probably be the case for some time to come, we think.

Around 8 pm there are quite a number of the V of A stations on the air, some of the best being KRCA on 6.06 mc and 6.185 mc, and also on 9.515 mc. Then there is KCBR on 9.6 mc and KGEI on 11.73 mc. Earlier in the evening we have KGEI on 6.155 mc, which gives the news in English at 5 pm. KCBR is also very good on 6.12 mc and 11.81 mc at 5 pm. Two other frequencies used by this station in the afternoon are 17.77 mc and 21.74 mc.

At 11 pm we have KCBR once again at great strength using 6.04 mc and 9.7 mc. Although not USA mainland stations but carrying the same programme, we have Honolulu on 9.53 mc and 9.65 mc opening at great strength at 7 pm, while there is also Manila I on 6.12 mc, Manila II on 15.25 mc, and Manila III on 11.89 mc, all well heard in Sydney.

In the early hours around 5 am you can find WRCA on 11.77 mc and 21.61 mc, WABC on 15.13 mc and WWH36 on 16.89 mc and WWH53 on 13.47 mc. Around breakfast time there is WLWO on 9.52 mc, WABC on 9.53 mc, and sometimes WRUL in place of WABC on this channel. WABC has also been heard on 9.65 mc and 9.67 mc at 7 am, while WLWO on 15.25 mc and WRUL on 11.73 mc are also heard at this time. WRUL is also on 11.78 mc but cannot be heard until New Zealand closes at 6.45 am. Others we have noticed are WABC on 15.27 mc and WLWO on 9.7 mc all around 7 am.

The General Electric stations have always been popular out here, and among these we find WGEO on 15.33 mc and 9.53 mc between 9 am and 10 am. WABC on 7.83 and WRUL on 15.35 mc carry the same programme at this time. Just after 10 am we find WRCA on 15.21 mc and 9.67 mc carrying a programme in Portuguese, when the latter outlet was very weak on the day we heard it. Around 3 pm the Cincinnati station WLWO can be logged on 9.56 mc with a faint signal from the same station on 6.04 mc.

The relay station in Honolulu uses 11.79 mc at 5.45 pm, while Manila I is on 17.78 mc at 6 pm, Manila II on 21.57 mc and Manila III on 15.33 mc.

The AFRS stations can also be heard both in the early morning from 5 o'clock and also at night from 7 o'clock, but we have not had time to check the various call letters as they do not announce as frequently as the V of A. However, we have noticed them on 9.55 mc and 15.15 mc at 7 am, while at night they are also using 11.86 and 11.9 mc in the 25 metre band and can also be heard at good strength both in the 31 and 49 metre bands.

To obtain verifications from all these stations would now be a tremendous task, and personally we have given it up as a rather futile job and not worth the effort.

We hope the above brief notes will enable listeners to make the most of the USA stations now on the air.

In recent months the Armed Forces Radio Service has not been verifying reports but, according to the Universalite, they are once again confirming listeners' reports. They are using a new card printed in red and blue, and their address is now A.F.R.S., 1016 North Mcadden Place, Los Angeles 38, Calif., USA.

NEW STATION LOGGINGS

Call.	KC.	Metres.	Location.	Time Heard.
YDP2	3230	92.65	Medan, Sumatra	1.00 am
YDM	3270	91.74	Bukittingi, Sumatra	1.00 am
YDO	3380	88.80	Bandermasin, Borneo	12.00 pm
YDI4	4840	61.98	Denpasar, Bali	11.30 pm
G . .	7135	42.05	London, England	6.00 am
YDL	7240	41.44	Padang, Sumatra	11.00 pm
YDQ3	7295	41.12	Makassar, Celebes	11.00 pm
AEF	9960	30.12	Brazzaville, F.E.A.	5.30 am
APK	17770	16.88	Karachi, Pakistan	10.00 pm
WFK38	18510	16.21	Rocky Point, U.S.A.	11.00 pm

FLASHES FROM EVERYWHERE

CEYLON: We have already made mention of the new commercial services of Radio Ceylon and, thanks to Radio Australia, we can now give the complete schedule of this station. No. 1: 21.62 mc, 8.30 am to 11.30 am; 15.12 mc, 11.45 am to 5.30 pm; 17.73 mc, 6.25 pm to midnight; 15.12 mc, midnight to 3.5 am. No. 2: 21.62 mc, 2.30 pm to 4.30 pm, except Sun.; 3.0 pm to 5.0 pm, Sun., 6.25 pm to 3.0 am. No. 3: 9.52 mc, 11.45 am to 5.30 pm, 11.975 mc, 9.30 pm to 2.30 am. No. 4: 7.19 mc, 9.30 pm to 2.30 am. No. 1: 250 watts, 6.075 mc, 12.30 pm to 1.30 pm; 3.0 pm to 6.30 pm, 8.30 pm to 3.0 am. No. 2: 250 watts, 3.395 mc, 11.45 am to 5.30 pm, 9.30 pm to 2.30 am. No. 3: 250 watts, 4.9 mc, same as the No. 1 250 watt transmitter.

PHILIPPINES.—Our northern neighbors always seem to be in the news in one way or the other regarding their radio stations, and the latest information we have from Arthur Cushen tells us that DZH5, on 9.69 mc, is now under new ownership and is known as "The Voice of Catholic Philippines." The retransmit station DZST, which uses 860 kc, and are on the air from 8.0 pm till midnight.

The Peoples' Station, DUH2, on 6.17 mc, carries the programmes of DZFM, a 1000-watt broadbast band station, from 7.0 am till 2.0 am. This station also operates DUH4 on 9.615 mc, and DUH5, on 11.84 mc, but at the present time there is some doubt as to whether these outlets are actually in operation.

CZECHOSLOVAKIA.—In a recent letter we received from the Czechoslovakian radio authorities, they enclosed their schedule of transmissions in English to the United States and Canada. Tranmission No. 1 is on OLR5A, 15.23 mc, from 10.0 am to 10.30 am, while transmissions 2 and 3 are of half-hour duration and come on the air at noon and again at 1.30 pm. These programmes use OLR4A, on 11.84 mc, and OLR5A on 15.23 mc. They state that these latter two transmissions are of a trial nature and repeat the programme carried in No. 1 transmission.

The morning programme in English from OLR3B on 9.505 mc is still being heard quite well at 6.30 am and also later in Spanish.

GERMANY.—We have often been surprised at the fact that the German stations have never been heard at anywhere the same strength as they were before the war. We particularly remember DJB, on 15.2 mc, which used to be heard at excellent strength in the evenings. Apart from the American stations at Munich, the loudest of the Germans we think is Leipzig, on 9.73 mc, which is quite good at 7.0 am, and also in the late afternoon.

According to a recent issue of the Universalite, latest German schedules are:—Baden Baden, 6.315 mc, 2.0 pm to 9.0 am; Frankfurt, 6.19 mc, 2.30 pm to 9.0 am; Munich, 6.16 mc, 2.30 pm, to 10.0 am; Stuttgart, 6.03 mc, 2.30 pm to 10.0 am. Most of the above stations can be heard at varying strength around 7.0 am.

MEXICO.—In the December issue we made mention of a new Mexican station which we were hearing in the early afternoon operating on a frequency of 11.90 mc. At the time we could not identify the call letters, beyond the fact that the first two were XE. In the latest issue of the NZ DX Times we note that this station is listed as XEX, in Mexico City, and relays the broadcast station of the same letters and uses the slogan "The Voice of Mexico." We have not heard it for some weeks now, but readers should keep a lookout on this channel.

There is also still no sign of the 24-hour Mexican XECC, which is said to have gone on the air on August 15 on 15.205 mc, relaying broadcast band station XEMC.

KENYA.—One of Graham Hutchins' correspondents, who provide material for his DX session over Radio Australia, sent along details of the Forces Broadcasting Station at Mackinnon Road, which readers will remember has lately been reported as being on 6.115 mc. It appears that they now have another frequency in use, 7.18 mc, and this one is on the air at the following times:—1.0 pm to 3.0 pm, 7.30 pm to 9.30 pm, and midnight to 5.0 am, Mondays to Saturdays, inclusive. On Sunday they transmit continuously from 3.0 pm to 5.0 am on Monday morning.

We have heard an English-speaking station on this channel around 4.30 am and are practically certain it is Mackinnon Road.

GERMANY: In the latest issue of Sweden Calling DXers they publish a paragraph concerning "Radio Free Europe," which we think may be the same station as we reported recently as heard on 6.13 mc. According to the paragraph we mentioned, Radio Free Europe is operated by "The National Committee for a Free Europe." Programmes are prepared at studies in the Empire State building in New York, and transmitted by a relay station somewhere in Central Europe. Transmissions are said to be beamed to all countries under Communist control. Six other transmitters are planned, including some medium-wave outlets. According to another source, they list the 6.13 mc station as "Radio Europa Libera."

IRAN: We hear from Art Cushen that he has verified an Iranian station, EPP, which operated on 4.04 mc, his report being the first received by the station. EPP is now supposed to be operating on 3.94 mc, with a power of 2kw. Other listeners report hearing a station on 6.845 mc with the same programme as EPB, on 15.1 mc, audible around 6.0 am, but, when reported to the Iran authorities, they made no mention of the 6.845 outlet. According to our lists, the following are listed for this country: "Persian Forces," 7.0 mc in Chelman, 7.95 mc in Shiraz, and 6.845 mc in Teheran. In addition, Teheran is assigned to EQD 4.78 mc, EQC 9.66 mc, EQB 6.155 mc, EPF 8.11 mc, and EPB on 15.1 mc. There is also an outlet with no call letters on 4.03 mc.

The last of these stations, LRY "Radio Belgrano," which uses 9.456 mc, is on the air from 7.0 am to 8.0 am in Spanish, and from 8.5 am to 8.50 am and from 12.15 pm to 4.0 pm, both these last two sessions being in English. Of these three stations, LRY is the best heard in Sydney, when it comes in quite well with their Spanish session from 7.0 am, and even better still in the afternoon till it leaves the air at 4.0 pm.

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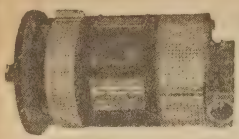

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12 Volt, 750 Watt	12	10	0
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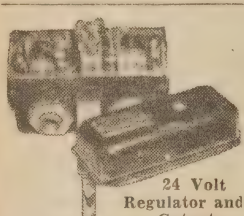

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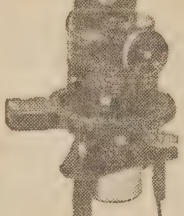

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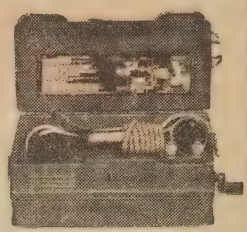

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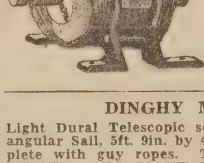
Metal pipes and cables can be traced quite easily in the ground. This saves the laborious, costly and time-wasting digging of "search holes" when the underground path of the pipes is uncertain, as it frequently is. And throughout all the metal detector "whistles while it works."

The unit consists of two interchangeable sweep coils, one large and one small, and is complete with carrying pack, valves and headphones, packed in strong wooden transit cases, 10in. x 12in. x 4ft. 6in. (total weight 80lbs.). PRICE £8/10/- EACH, F.O.R.



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Postage and Packing: Vic., 3/6; N.S.W., S.A., Tas., 6/-; Q'ld., N.T. 8/9.

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24-volt, approx. 1/6 H.P., reversible motor, fitted with 5000 to 1 reduction gear and magnetic Brake. EACH **£2/17/6**

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80-volts D.C. with laminated field. approx. 1/10 H.P. **45/-**

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Combined 24-volt motor and High Pressure Hydraulic Pump, 600lbs./square inch **£3/15/-**

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24-volt, A.C., D.C., 1/40 H.P., with laminated field . . **50/-**

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£9/10/-

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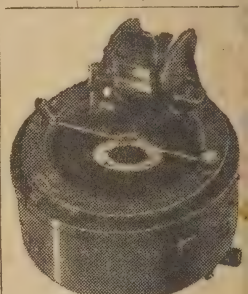

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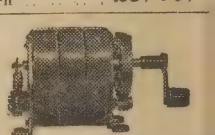
Liquid Damped, Card Type. 6¼" dia. x 3¼" deep, fitted with large viewing prism, ideal for small craft, etc., for normal navigation and also taking bearings, Each **£6/10/-**



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A very useful instrument for the Air Trainee. Marked with a Port and Starboard drift indicator, contained in a wooden case 11in. x 6in. x 2¼in. PRICE, each **12/6**

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Ideal for use on Rifle Ranges, etc. Approx x6 magnification. *Postage and Packing: Vic., 2/9; N.S.W., S.A., Tas., 4/6; W.A., N.T., Q'ld., 6/3.*

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With a variable magnification of x5-x15. Originally cost £75.

OUR PRICE . . . **£9/10/-**

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THE HAM BANDS WITH BILL MOORE

CIVIL DEFENCE ROLE FOR AMATEUR RADIO

A new conception of the value of Amateur Radio in emergency arises from a report "U.S. Civil Defence" recently published. During the last two World Wars the first move was a hurried withdrawal of licences and the impounding of equipment. Today, it would appear, defence authorities are forced to consider amateurs as a possible source of communication.

THEY are fully aware that modern warfare and an A-bomb attack means the destruction of communication services over wide areas.

Amateur radio has been singled out as being able to supply both operating personnel and equipment and act as an additional net.

The report, which in the US has received President Truman's approval, was released by the National Security Resources Board and amateur radio operators were marked out for special mention as follows:

"Amateur radio operators and networks will be used in civil defence communication. They are licensed radio operators and their radio-telephone and continuous wave equipment can be utilised as secondary services, thus providing for maximum flexibility. Under an organised plan, amateur radio operators will make an important contribution to civil-defence communications."

The plan outlined in the report not only covers communication but all aspects of civil-defence, and President Truman has announced his intention of setting up a temporary Civil-Defence Administration to bring it into effect.

The whole problem of communication will be dealt with by the administration and it would appear that the greatest obstacle to overcome will be security measures to prevent the disclosure of valuable information to the enemy through radio—particularly vulnerable from the security angle.

The whole scheme is of particular import to all amateurs and the actual arrangements, as they finally appear, should disclose many points of interest.

The ARRL Emergency Corps in Seattle recently assisted in a comprehensive simulated test during which amateur radio facilities were integrated with normal communications services. The actual test was organised by the National Security Resources Board, responsible for the report mentioned previously, and was termed "A-Bomb Test." Theoretically, two A-bombs were dropped on Seattle and the full civil-defence organisation was swung into operation.

Some 95 amateurs assisted in the test, including those who acted as operators for service stations. Others supplied and manned mobile and fixed stations. 29,000 kc/s was used as an emergency frequency and all mobile stations operated in the 28-30 mc band.

Fixed stations operated on 3.5, 7 and 144 mc bands as well.

Amateur assistance proved valuable and was officially recognised. The whole scheme afforded the opportunity of gaining much valuable information for future civil-defence planning, besides showing the capabilities of the amateur service.

We really should mention that effective use of amateur operators and stations was made here in Sydney during the past war. Stations operated under the National Emergency Services and Wal Ryan (VK2TI) was responsible for the organisation. The idea of a complete system organised and trained in peacetime is the ideal.

RECENT W.I.A. ACTIVITIES

THE Tasmanian Division of the W.I.A. was the winner of the Remembrance Day Trophy for 1950, the second year in succession. VK7RK, 7JB, 7PF, 7OM, 7AL and 7LJ comprised the winning team and compiled a handy total as the six leading stations in the State. They won by a narrow margin from the Western Australian Division.

Highest individual scorer in the contest was Peter Alexander (VK2PA), who, using four bands, contacted 227 stations and scored 621 points. VK6RU contacted 232 stations and scored 558 points, VK7RK 202 stations and 532 points, and VK7JB 201 stations and 523 points.

The contest is by far the most popular run by the W.I.A., 317 stations submitting logs and considerably more stations participating. Full results of the contest appeared in Amateur Radio.

The December meeting of the Hunter Branch of the W.I.A. took the form of a Christmas gathering and there was also an exhibition of some pieces of amateur equipment — VK2ZC displaying a VFO, VK2AXM a complete midget transmitter and VK2XT a signal generator. State President Jim Corbin (VK2YC), State Secretary Dave Duff (VK2EO) and councillors Vaughan Wilson (VK2VW) and Dave Evans (VK2AYE) journeyed up from Sydney to attend the meeting.

The Ross Hull Memorial Trophy VHF contest, run on 50 mc, has just concluded and was extremely well supported. Conditions were extremely good and plenty of sporadic E openings occurred, at least one a day during the three weeks. Some openings lasted at long as 15 hours.

Short skip was also present at times and contacts were made in the 200-300 miles range.

Some of the Western Australian stations recorded more than 100 contacts, a feat that was not thought possible a few years ago.

Excellent individual scores were compiled and it appears that the winner could come from any State. VK2ADT and VK5QR seemed to work the greatest number of stations and both should be well up among the winners.

Just before the conclusion of the contest VK2ADT had made 234 contacts, including 21 with VK6 and 65 with New Zealand. At one stage 48 contacts were recorded in 24 hours. VK2VW and VK2ABC were also scoring well in NSW.

The winner should come from VK2, 4, 5 or 6, but VHF contests are hard to follow, so one can't estimate. The full review and results will appear in Amateur Radio. Logs should be in the hands of the contest committee, NSW Division, by February 12; the address: Box 1734, GPO, Sydney.

The W.I.A.'s North Coast annual convention will be held as usual at Urunga over Easter. The committee has arranged a very full programme and they are confident that a record attendance will be made.

Programmes will be posted to amateurs throughout the State.

To enter in the field events, 7 and 144 mc equipment will be required, and the following are the events.

On 7mc the contest for the Challender Memorial Trophy will be conducted. Stations will operate within eight miles of Urunga. There will be no power limit, but stations must use portable power supplies. The final result will be judged on a power input handicap basis. The trophy is a cup valued at £20 and the winner will receive a replica and £2; second a high speed soldering iron.

The transmitter search will be run on 144mc. The hidden station will be located within a three-mile radius of Urunga. The cup, valued at £15, is for annual competition and the winner will receive a replica and £5; second prize is £1/1/-. The transmitter search will be the big event of the convention and amateurs throughout the State are working on varied antenna systems for the hunt.

The other field event is the "Urunga Scramble," any band, any power, any equipment can be used and stations participating will endeavor to contact as many stations as possible in an hour. First prize is 500 QSL cards and second a pair of 807's.

You can see it will be an interesting event so if you desire to attend contact Crieff Rettalick (VK2XO), of Raleigh, or any of the North Coast gang, who will pass the information along.

BERU CONTEST, 1951

THIS year's contest is run on similar lines to that of last year. The BERU always attracts a few of the old stalwarts and is perhaps the most popular DX contest. The main rules are as follow:

Two sections, junior and senior, the first limited to 25 watts input.

The telephony portion of the contest runs from 1700 hours GMT, February 3, to 1700 hours GMT, February 4, and limited to 14 and 28 mc operation.

The CW section runs over two weekends from 1700 hours GMT, February 24, to 1700 hours, February 25, and again from 1700 hours, March 3, to 1700 hours, March 4.

Call CQ BERU, and you are required to work stations in the British Commonwealth.

Five figure serials are exchanged on telephony, six figure on CW. RS or RST reports, plus a three figures starting at any number between 001 and 400 and increasing by one each QSO.

The Commonwealth is divided into Zones and 15 points scored for first contact, 14 for second and so on, repeated on each band.

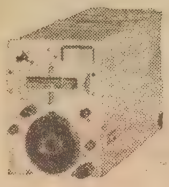
Zones are as follow:

1—AP, VU2, 4, 5, VS7.
2—G, GC, GD, GI, GM, GW.
3—DL2, MB9.
4—MD, MF, MS, MT, ZB. 5—MI, ST.
6—VEI, 2. 7—VE3. 8—VE4, 5, 6.
9—VE7, 8. 10—VK2, 3. 11—VK4, 7.
12—VK5, 6. 13—VK9, VR4. 14—VO.
15—VP1, 3, 5, 7, 9. 16—VP2, 4, 6.
17—VP8, VK1. 18—VQ1, 3, 4, 5, ZD6.
19—VQ2, ZE. 20—VQ8, 9, ZC2.
21—VR1, 2, 3, 5, 6, ZK, ZM.
22—VS1, 2, 4, 5. 23—VS6.
24—VS9, MP4. 25—ZD1, 2, 3, 4, 7, 8, 9.
26—ZL, 27—ZS1, 2, 3.
28—ZS4 to 9.

Logs should be posted within a week of the completion of the contest (telephony or CW) and should reach the RSGB by June 4, 1951. RSGB, New Ruskin House, Little Russell Street, London, WC1.

If not a member of the RSGB the log should be certified that the entrant is a member of the WIA or NZART. Full details of equipment should be supplied

ELECTRIC COMMAND TRANSMITTERS



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Price, complete with valves and crystal **£6/17/6**

Packing and postage N.S.W., 2/9; Qld., Tas., Vic., 5/-; S.A., W.A., N.T., 7/3.

17-VALVE TRANSCEIVER

TYPE TR1143

Freq. Range 100-130 mcs. Crystal controlled transmitter and receiver. All 6-volt valves—4 freq. channels. Ideal for 2-way radio installations. Complete with valves. **£15/-/-**

Price . . . . . .

Filtered Genemotors to suit above.

28-Volt Input £2/5/-

12-Volt Input £4/10/-

A.W.A. CRYSTAL CONTROLLED TELERADIO TRANSMITTERS

15/20 WATT

Frequency Range 2-10 mcs. Valves: 4—Type 6V6G; 1—Type 807. Complete with built-in Vibrator supply for 12-volt operation. Ideal for Ships' communications, etc. **£25/-/-**

PRICE, complete . . . . . F.O.R.

Excellent Condition.

DISPOSAL VALVES, TESTED

1K7G	8/6	955	12/6
3Q5GT	10/-	956	12/6
6AC7	14/-	9001	10/-
6AG7	20/-	12A6	10/-
6H6GT	7/6	12SG7	10/-
6SH7	8/6	12SK7	10/-
6SH7GT	8/6	12SR7	10/-
7193	8/6	EA50	5/6
852	25/-	CV6	8/6
954	12/6	VT90 Micropop	10/-

NEW VALVES

1D8GT	15/-	83V	11/-
6H6	10/-	811	70/-
6J5G	11/-	837	25/-
6SQ7	12/6	879/2X2	15/-
6X5GT	12/6	1294	11/6
7A6	10/-	1293	11/6
7C7	11/6	VR54/EB34	5/-
		VR65A	5/-

IMA METER RECTIFIERS

Ideal for AC Meters and Multimeters, etc. **15/-**

Price, each . . . . . .

Postage 6d each.

BATTERY CHARGER RECTIFIERS

12 volt, 5 amp 39/6

12 volt, 1 amp 25/-

Packing and postage extra.

TELEPHONES Type H. Mk11

Field type, complete with magneto, bells and sound-powered push-to-talk handset (no batteries required). Mounted in metal carrying case with strap. Size 10 x 5½ x 4½ inches.

Brand new in original sealed cartons. Weight packed 12lbs.

PRICE, **£4/7/6**

F.O.R. . . . . .

IFF GENEMOTORS

Ideal for conversion to 240 volts A.C. Motor. Input 24 volts, 1.74 amps. Output 480 volts, .04 amps. Supplied complete with reduction gearbox to approximately 5 r.p.m. **35/-**

Price, each . . . . . .

Packing and postage: N.S.W., 3/6; Qld., Vic., Tas., 6/-; S.A., W.A., N.T., 8/9.

SHIELDED PLUGS AND SOCKETS

4 pin as illustrated Quantity available.

Price, each **4/6**

Per doz. **45/-**

Packing and postage 6d each. Per doz., N.S.W., 1/6; Qld., T., V., 2/6; N.T., S.A., W.A., 3/6

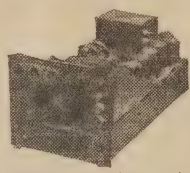
WESTINGHOUSE VOLTAGE REGULATOR 24-36 VOLTS

Ideal voltage control for aircraft and home lighting, generators, etc. **50/-**

PRICE, each . . . . . .

Packing and postage, N.S.W., 2/3; Qld., Vic., Tas., 3/3; S.A., W.A., N.T., 4/6.

U.H.F. A.S.V. RECEIVERS AR301



Complete with 11 valves: 2—R.F. stages, 954 acorns, mixer and oscillator. 2—955 acorns; 30 mcs. I.F. channel. 4—6AC7's; detector 6H6; cathode follower 6AC7; rectifier 5V4G.

Coaxial switching motors 24-volt D.C. Frequency range, 160-190 mcs.

Weight unpacked, 30lbs.

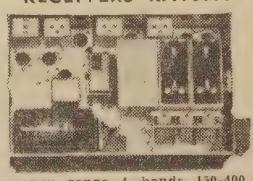
Suitable with minor alterations for conversion to F.M. Band (88-108 mcs.). Television Band (175-200 mcs.). 144 or 288 mcs. amateur bands.

Complete with valves as above in vented metal case, size, 7½ x 8½ x 18 inches.

PRICE, **£8/15/-**

F.O.R. . . . . .

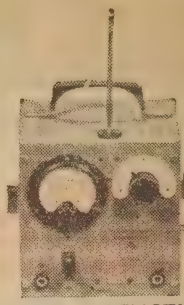
BENDIX AIRCRAFT COMMUNICATIONS RECEIVERS RA10FA



Frequency range 4 bands 150-400 kcs. 2.0-5.0 mcs, 2.0-50 mcs, 5.0-10.0 mcs. H.T. dynamotor 24v input 250v at 100 mA output. Small 24v A.C./D.C. motor. Filaments wired for 6v A.C./D.C. Socket ready mounted and space for rectifier and A.C. power supply. Valves used: 3—6SK7, 6K8, 6R7, 6C5, 6H6, 6K6.

Price, less valves F.O.R. **£11/10/-**

Remote control box with calibrated dial, etc., to suit above. Each **35/-**



FIELD STRENGTH METER-MONITOR

TYPE 98

Frequency range 100-130 mcs. or can be converted to any other freq. range by altering one coil. Complete with 1N5G valve, imported 3-inch 0-1 MA meter and chrome-plated telescopic aerial. Jack provided for using meter for external measurements, also necessary plug and lead. Batteries encased within the unit. Size 6½ x 7 x 7 inches. Supplied in portable carrying case.

Price, New, Complete, **£4/10/-**

less batteries, F.O.R. . . .

Weight packed, 15lbs.

4W FLUORESCENT LAMPS

Colour: Blue. Length, 5½ inches. Ideal R.F. Indicators.

PRICE, Each **2/6**

Per Dozen **25/-**

Packing and Postage, 6d each.

METERS

0-10 mA., D.C. 2-inch round flush, new	22/6
0-30 mA., D.C., 3-inch round flush,	25/-
0-30 volt D.C. 3-inch round flush with datum indicator	30/-
0-300 mA., themocouple. New	15/-
0-3 Amp. R.F. thermocouple. New Imported 2" square flush	17/6
0-4 Amp. R.F. thermocouple. New Imported 2" square flush	17/6
20 mA., D.C., 300 amp. scale, 3in. round flush	25/-
20 volt D.C. 2in. square flush, imported. New	20/-
40 volt D.C. 2in. square flush, imported. New	20/-
50 Amp., D.C., 2in. round flush, imported. New	30/-
0-500 mA. R.F. Meters, 2in. flush	17/6
20 volt and 200 volt D.C., 2in. round dual reading with leads. New	20/-

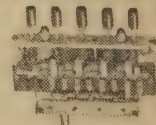
Packing and Postage, 1/6 each.

GENERATORS

12-volt, 40 amp, D.C. (F.O.R.) Each **£9/10/-**

Ideal for home lighting plants, battery charging, plating, etc.

PUSH-BUTTON SWITCHES



5-pole each 2 pair of contacts. Made in USA. Ideal for receivers, multimeters, etc.

Price Each **12/6**

Packing & Postage, N.S.W., 9d; Interstate, 1/6.

ELECTRONIC EQUIPMENT CO.

Please add exchange to all cheques. Make money orders and postal notes payable at Lewisham. Sorry, no C.O.D.

29b West St., Lewisham, Sydney. OPP. END OF LEWISHAM HOSPITAL (ADJOINING RAILWAY LINE) **LM3555**

HAM BANDS

(Continued from Page 87)

and also a zone analysis sheet showing number of contacts and points claimed with each of the 28 zones on each band. Logs should show date and time of contact, call, band, serial numbers sent and received and points claimed.

DX AND PERSONAL

ZS2MI is still active on Marion Island and is on most nights from 1300 GMT onward—operates mainly on schedule, but can be picked up between contacts.

Over the holiday period the DX on 80 was quite good, Europeans rolling in between 0400 and 0500 hours EAST like ZL's. VK2XQ worked a KP4 with only 10 watts input.

On 50mc in Fiji VR2CC has taken over from VR2BC, who has moved back to New Zealand and will be looking out for VK's in 1951.

The DXCC totals are still growing, although the telephony gang hasn't reached the double century mark as yet. W1FH still leads on both CW and telephony, with 236 countries confirmed using the former and 195 with the latter. W8HGW 230 and W6VFR 229 are next on CW and XE1AC 186 and W6DI 181 are next on telephony.

DL4ND has been operating from Monaco using the call 3A1A and should be operating again during February. If it is anything like his last session there in September the W stations will win out.

GW3ZV really set out to win the European section of the last ARRL DX contest. His comprehensive antenna set-up was as follows:—28mc: Three element beam and Sterba Array. 14mc: Four element beam, 7.5 and 7 mc Vee beams and a 900-foot receiving antenna.

Some of the DX gang are still passing the rare ones on to their friends and causing much gnashing of teeth among those waiting to make a contact. It is generally accepted these days that these are stations should not be passed about, but that every station standing by should have an equal chance of making a contact.

Amateur Radio recorded another fine effort when the ss Marblehead was on fire at Carcos and Turks Islands, near Jamaica. VP5BF, which operates from Carcos, called for assistance for the vessel on the 14mc band. The call was answered by W2QHH, which relayed the message back to KP4QZ in Puerto Rico, which informed the Coast Guard. Finally, the hook-up was extended. W41KC, W40PG and KP4KF joined in and the owner of the vessel was informed and he despatched a plane to pick up the crew of the vessel, who were finally stranded. All the arrangements were satisfactorily carried out via Amateur Radio.

OFF THE RECORD — NEWS & REVIEWS

How much have our listening habits grown up around the "one item per side" convention imposed upon us by the 78 rpm gramophone record? Will the long-playing technique bring with it new ideas and standards of listening?

By JOHN MOYLE

I COULDN'T help thinking along these lines when playing through some of the long-playing types in the last few weeks.

Ignoring large works for the moment, which of necessity have to be recorded on more than one disc, by far the majority of 78 records are contained within the limits of a single side. Some go to two sides, but they are well in the minority.

Long conditioning through getting up from a chair during the last bars of the music, or waiting for the performance to end has, I fear, made us ready with conscious or unconscious sales resistance to any other form of record listening.

A good example of what I mean is contained in remarks I have heard passed concerning "long players" which contain several numbers by the same artist or artists on a single side.

In effect, these can be summarized as "Who wants to hear four songs, one after the other, by the same singer? We'd sooner mix them up a bit."

But would we? More than that, might I ask in what other form of listening would we be happy to hear a song from one artist, watch her scurry from the stage in favor of another, to be replaced when done by still another, in a rather exhausting and confusing procession of harmony?

That's not the way a good concert—or coming closer to home, a good broadcast—is arranged.

In the case of a mixed concert where several artists appear, we invariably hear a "bracket" (horrible word!) of numbers, plus a possible encore, before we settle down in our seats while the stage is set for the next performer. For the purposes of discussion, let's assume that each performer has a 15-20 minute "spot," and may appear in similar roles twice on the same programme.

Don't we find this occurring as a regular thing, and don't we like it? Doesn't the concert arranger spend some time in striving for a balanced programme, in which the audience leaves emotionally and musically satisfied?

PROGRAMME BALANCE

If we consider the case of a recital by some first-rate soloist, much the same thing happens, except that, for variety, a second performer in a minor role will oblige, again with a few "brackets" according to his scope and ability.

I've never yet heard anyone clamoring for a fundamental change in such a procedure. In fact, I think it would be fair to say that a good recital concert is likely to be better supported than one which mixes things up a bit, particularly if the items were mixed in the manner familiar to the record-changer addict.

Now consider the possibilities of the long-playing record. Isn't it logical to think that records which can play for 15 or 20 minutes at a stretch would be ideal to bring just such "brackets" and short recitals into your own home?

After all, if one likes the "Three Spots," it's reasonable to think that a 15-minute burst of them will be just as acceptable as one of 4 minutes, particularly if the numbers are arranged so that you can pick out the items individually, if on some occasions you'd prefer one more than another.

RECITALS

I've heard some excellent recitals of operatic arias—four to a side—with full orchestral accompaniment which made really good listening for about 20 minutes.

Carried further, one can imagine some effectively arranged recitals for piano, violin, etc. occupying about this time, in which the performer could make his pace as he wants it without having to keep his eye on

clock, or to miss a few bars or repeats to beat the needle to the last groove.

I have even gone so far as to make some records for myself on micro-groove, arranging a programme to my own taste from recordings I have. Frankly, I thoroughly enjoy hearing them played that way, and in their selected order, without getting up until it is all done.

It will be highly interesting to see whether this idea of "recitals on records" goes down with the public or not.

One catch might be that the micro-groove records are rather expensive, and except to the serious collector, the preference might still be to invest an equal sum in a larger variety of single numbers.

TIME LIMITS

The point I'm making, however, I think is quite an important one, and that is that we should try to rid our minds of the time limit in record listening. Believe me, its one of the greatest boons the modern record has to offer. When I was younger, I got used to breaking evens across the room to change a record without loss of time, not forgetting the frequent double trip necessitated by poor judgment when estimating when the record was due to finish. We've all made the trek, only to find that the blessed thing still had a minute to go, and tossed up whether we'd wait for it, or resume our seats.

No, those things must fade into the past, where distance will lend enchantment. Nothing else can.

CONCERT HALL

And while I'm about it, I might mention once more another matter on which I have decided views. It concerns the idea that recorded music is some inferior kind of substitute for the real thing, and not to be taken seriously by anyone who is really interested in music.

I have never been able to see the logic in the idea that music should only be heard in a concert hall. I believe that to play it through your gramophone is just as legitimate a method of hearing it as is any other.

The truth is that a "concert hall" is not a definable thing. No one will maintain that any two halls are alike, nor will they deny that some are so atrocious that the music is positively mutilated by unwanted reflections from walls and ceilings, and by excessive reverberation which brings with it distortion and confusion.

SOCIAL ASPECT

Moreover, the music will sound quite different to the man in the gallery above the orchestra, as against the man sitting on the ground floor near the back, or the sides. Neither can hear anything like as much as the third man, who hears a well-arranged broadcast through a really good radio, or a well-recorded performance through the same medium.

The major difference between the real and the recorded, I think, is more a matter of a trip to the city for a new dress, the company of others who attend the concert, and the actual sight of the audience and the performers. Strictly speaking, it isn't fundamentally a matter of the music at all. Both listening conditions require the same mental conditioning before they are accepted as normal. If we had taken up the habit of going to concert halls after a couple of hundred years of recorded music, we'd probably think the presence of others a distraction and an intrusion.

I don't think Beethoven is the less enjoyable through a good gramophone than in a concert hall. In most ways, I think, I like him that way. I'm more comfortable before a fire than I would be trekking through a cold night, enduring the consequences of other people's incipient influenza. And much as I may be willing, on odd occasions, to sit it out on a hard chair in a hall, I have a much more comfortable seat at home, and I can choose my listening companions as well.

DIFFERENT IDEAS

I'm not attempting to compare the two types of listening, any more than I'd compare either with the growing habit of sitting in a public domain listening to an orchestra sweat it out on a hot day (half the sound coming direct, the remainder from unpredictable angles through atrocious loud speakers) and endeavoring to ignore a less-absorbed citizen eating peanuts. If you like to hear music that way, I wouldn't growl, as long as I don't have to share it. I am much happier with my records, and I think I get more from my music.

I know there are other angles to concert-going, but I'm not being sidetracked by them. I'm asserting that recorded music is a legitimate method of propagation in its own right — an important and valuable one, and one which should not be regarded as a poor imitation of the "real thing."

There isn't any "real thing." There are just several ways of hearing the same thing. But there is, I fear, a good deal of confused thinking and intolerance which may often spring from the fact that all gramophones aren't good ones.

I think many will change their views on the matter when they are able to hear good long-playing records on good equipment. It makes such a difference!

Radio active Chemicals

TOY electric trains are being used to carry radioactive materials from one room to another in the Packard Radiation Laboratory at the Cleveland Clinic Hospital in Cleveland, Ohio, USA.

In one case, a run is only 22 feet in length. No detours are necessary, of course, as the track passes through openings in walls. Over a period of time, by relieving hospital personnel from having to carry the ray-emitting material themselves, the train reduces the day's exposure to within the maximum allowable limit.

SET FINISHED?

(Continued from Page 67)

out of your batteries equal to several weeks running, just while you are wondering why the set doesn't work.

With all the valves removed and the switch on, touch the L.T. leads across the "A" battery, and watch for sparks. If there are none, connect one lead permanently to the battery, and, if available, connect a current meter of some kind in series with the other. The 250 m.a. position of a multimeter will usuall be suitable. There should be no current drain under these conditions.

Treat the H.T. circuit in a like manner, but, if there is an electrolytic across it, there may be a drain of fraction of a milliamp. This is quite normal, but there should be no drain when the switch is in the "off" position.

FILAMENT CHECK

Connect both sets of batteries to their respective leads, and carefully check across each pair of filament pins with a voltmeter. To avoid damage to the meter remember that there may be up to the full H.T. voltage across the pins. After going over them with the high range, repeat the operation with the low range.

In the event of no meter being available, select a torch globe having a rating as near as possible to the filament voltage, and connect this across each pair of filament pins in turn. It should light to normal brilliance, unless of course there is some H.T. mixed in somewhere.

If all is well give the chassis a careful check for obvious faults, as well as the stray blobs of solder (or) of these can blow a set of valves and then plug in the valves. Once again you can start looking for stations, or a minor fault, with a clear conscience.

But for heaven's sake keep your screwdriver out of the works while you are looking. It can short things.

R & H HARMONIC OSCILLATOR

(Continued from Page 65)

This is in the form of an image of the original signal, occurring at a point removed by twice the intermediate frequency. With a standard 455 kc IF the image will be 910 kc from the real signal. This is close to where the next marker point from the oscillator should occur, and may cause some confusion.

The best way to minimise this effect is to keep the input signal strength to an absolute minimum. If necessary, reduce the coupling to the oscillator until the set is barely able to receive its signals, under which conditions it should be able to reject the image completely.

With the basic calibration completed it should only be necessary to make adjustments over a very small range as provided by the air trimmers on the front panel, and then only when very accurate work is contemplated.

ANSWERS TO CORRESPONDENTS

R.M. (Randwick, NSW) wonders if we can supply him with the circuit of an electronic keyer.

A.: We have seen a number of references to such devices in overseas publications but, as yet, we have not had the opportunity to carry out any experiments first hand, we cannot help you with the circuit.

V. P. O'B. (North Kew, V.), forwards twelve months subscription and advises of a change of address. He asks who to contact regarding his amateur licence.

A.Your subscription has been forwarded to the apropriate department and the change of address noted. Regarding your ticket, contact the Chief Wireless Inspector, C/o GPO, Melbourne, and submit all details of your NZ licence.

E. A. C. (Blakehurst, N.S.W.) says he is a new reader of Radio and Hobbies and wishes to obtain a recommendation on a suitable textbook covering the principles of radio, particularly "amplification."

A.: Well, E. A. C., there are a number of suitable textbooks available at the present time. Here are a few:— An Elementary Wireless Course for Beginners by J. H. Reyner; Fundamental Principles of Radio by R. H. Humphrey; Elements of Radio by Charles I. Hellman. However, as stock positions vary, titles change and new books become available, we suggest that you communicate with Angus and Robertson's or Swain's or other leading booksellers in Sydney or McGill's Agency, 183 Elizabeth Street, Melbourne, C1, and obtain a current list of books in the field in which you are interested.

C. W. M. (Kadira S. A.): Recently obtained his amateur ticket and is having a little trouble with his first attempt at a large communication receiver.

A.: Your instability trouble is probably caused by excessive gain in the IF stages, as it is usual when two stages are used to fit low gain transformers. The transformers you are using were probably not intended use in circuits having such high gain, and so the overall gain is more than can be controlled. We would suggest that before changing the transformers you reduce the gain in the I.F. stages by reduction of screen voltage to one or both the I.F. valves. The VR65A is a 4-volt version of the VR65, and has a filament current rating of 0.95 amps. Base connections will be the same in both cases.

D. P. (Brighton, Vic.): A young reader of Radio and Hobbies asks about printing and developing of films.

A.: You will find an article on the development of film in the January, 1951 issue and, in this issue, there is an article on making contact prints from the negatives. We trust that these two articles will be of interest to you and that, as you gain more experience with your new camera, the information contained in such future articles will come to mean more.

K. G. C. (Stockton, N.S.W.) tells us in a recent letter of his interest in the articles on photography which have appeared in the magazine.

A.: We were pleased to receive your letter, K. G. C., and, from the number of letters received and the remarks included in letters on other subjects, the inference is that there are quite a number of hobbyists who are interested in photography, either solely or in conjunction with other interests. There are a number of articles on photography projected and we doubt the points raised in your letter will receive due coverage.

C. C. (Sunny Cliffs, Vic.) is another reader who has voiced his approval on the appearance of articles on photography.

A.: Many thanks for your letter, C. C. We are pleased to note the response to the articles on this subject. Other articles are projected and in this issue you will find one on making contact prints from negatives.

R. J. M. (Sturt S. A.) Sends twelve months subscription, and a problem concerning The All Wave A.C. Ten.

A.: Thanks for your subscription R. J. M., which has been forwarded to the appropriate department. Your trouble with the alignment would seem to indicate that there is too much distributed capacity in the wiring associated with the tuned circuits. Another possibility is that the coils need some slight adjustment, but this is not likely with the commercial coils. Also you do not say whether the trouble is confined to one band. We would suggest that you check the wiring for anything which might cause excessive capacity across the tuned circuit, such as long leads running close to the chassis. If the trouble persists, and is confined to one band, we suggest that the coils may be adjusted slightly. The easiest way would probably be to decrease the inductance of the aerial and R.F. coils, and sufficient variation may possibly be obtained by slight spreading of the turns.

J. T. (Oakleigh, Vic.): Sends us problems dealing with radio control, wind chargers, and the "Tiny Tim 2."

A.: Many thanks for your letter and good wishes J. T., and we are listing as much information as possible on the subjects you mention. (1) Not having the circuit of the transceiver we cannot give exact details. However, there is no reason why I.F. coils cannot be used in a Colpitts circuit. In fact you will find an article elsewhere in this issue showing how this is done, though for a different purpose. (2) The article to which you refer was a reprint from an overseas magazine, and we have no further information on the subject. There is no real difficulty in using wind as a source of power to generate alternating current. The type of current will depend on type of machine driven, in this case an alternator. The obvious objection to a-c for the normal windcharger application is that it cannot be stored in a battery bank as is the case with d-c. (3) It should be possible to use the "Tiny Tim 2" as a radiogram, by feeding a high output pick-up, such as a crystal, into the grid of the EL3. We are very glad to hear that the various R and H sets which you have built have met with such success.

YOUR QUERY?

1. Queries will be answered in rotation through the columns of our magazine if not accompanied by a fee for a postal reply.
2. Queries, neatly and concisely set out, will be answered by mail as quickly as possible if accompanied by 1/- in postal notes or postage stamps. Endorse envelope "Query."
3. Back numbers are rarely available but reprints of most circuits, wiring diagrams, and parts lists will be supplied for 6d each, minimum charge 1/-. Thus a circuit, layout, and parts list will cost 1/6 in stamps or a postal note. Endorse envelope "Circuit."
4. Blueprints of exact size chassis layouts with all essential holes, and cutouts will be supplied if available for 2/6. Endorse envelope "Blueprint."

Address your letters to the Technical Editor, "Radio & Hobbies," Box 2728C GPO, Sydney.

J. R. A. (Hawthorn, Vic.) wishes to construct a record player suitable for both standard and long playing discs.

A.: You will need a pick-up capable of using both standard and small diameter styli and the most satisfactory solution appears to be a pick-up with inter-changeable heads or styli. These are available in both magnetic and crystal types. Crystal type would probably be a better choice in your case since it does not require an elaborate amplifier with special tone compensation. The Acos GP-20 is a good example of this type. You will also require a motor and turntable capable of operating at both 78 and 33 1/3 rpm. Dual-speed motors of good quality have been both expensive and difficult to obtain although the position is improving. We will be happy to supply the circuit of a suitable amplifier should you care to write to us through the 1/- query service. Be careful to specify the pick-up you intend to use.

J. C. V. (Bayswater, W. A.) would like to see the circuit of a dual-wave receiver, using the latest 1.4 volt miniature valves, described.

A.: We are well aware of the demand for such a receiver and intend to devote some space to it in an early issue. However, at the moment the dual wave bracket you mention is not in large quantity production, although we hope to have better news from manufacturers shortly. Thanks for the favorable comments.

K. S. C. (Brisbane, Qld.) is anxious to obtain the circuit of a BC 348-Q receiver.

A.: Sorry, K. S. C. but we do not keep circuits of commercial or disposals equipment. If perhaps one of our readers could help you they may care to write to you privately. The address is Mr. K. S. Collins, Callon Street, Grovelly, Qld. Many thanks for your kind wishes with regard to Radio and Hobbies and we trust that we will be able to continue to provide you with much interesting reading.

N.C.S. (Williamstown, Vic.) queries the accuracy of the circuit and wiring diagrams of the "50-Three."

A. As far as we know, both diagrams are correct. All diagrams published in Radio and Hobbies are carefully checked by several members of the staff, but it is always possible for an error to creep through. If you care to write us again giving details of the alleged errors, we would be happy to clarify the position.

A.J.E. (Fremantle, WA) is anxious to obtain further information on making things from perspex.

A. We regret that we have no information on the subject other than that already published in Radio and Hobbies. Actually, the information came from an overseas publication. It may be worth your while to write to P. Rowe & Co., 297 Castlereagh Street, Sydney, since they deal in material of this nature.

S.H. (Lane Cove, NSW) wishes to make a one valve receiver using a 1D8-GT and a loop aerial.

A. We have not carried out any experiments with such a set, but since the gain of the two sections of the 1D8-GT in cascade is fairly low, we can expect the results to be mediocre only. "Tex" used two pentode valves and the gain would be somewhat higher. If you feel like experimenting, you could try the coil data specified for "Tex" with the "Duplex Single" or similar circuit employing a 1D8-GT.

M.C.H. (Neutral Bay, NSW) writes to thank us for the present series of articles on photography.

A. Many thanks for your letter which is greatly appreciated. Mr. Watson, who has recently joined our staff has had a great deal of experience in these matters and you can look forward to further interesting articles. Your suggestions have been noted.

HOME-MADE SPOT WELDER

(Continued from Page 73)

arm or pillar to which is anchored the outer cable.

The foot pedal is very simple to make, and can be just a board hinged to a fairly heavy base, the cable being anchored in the usual manner.

The simple foot control shown is more robust, and is very simple to make and easy to handle (Fig. 4). It consists of a mild steel strip, ½in by ¼in, with a treadle, 1½in by 2in welded to one end. The other end is welded to a simple wood hinge which is screwed to the baseboard.

A bridge piece from ½in by ¼in strip is bent over the arm and screwed into the base. A fine hole is drilled through the bridge to take the wire which passes through a hole in the pedal. At one end the wire should be easily adjustable so that, when necessary, any slack can be taken up.

A connection made from a short length of cable, as flexible as possible, must be fitted to the top arm. For this make up your own sample, having first determined the minimum quantity required by trial with a length of stiff wire. Take about ½lb of No. 20 wire, anneal it dead soft and clean and straighten it out.

Cut into lengths as required and twist them all together to give a firm yet flexible cable. Solder one end to the top spade terminal to make a good contact to the battery.

Connect everything up. Place the battery and welder on a bench of suitable height, and connect the flexible lead to the lowest voltage say, 2 or 1.25. Place two thin pieces of steel plate between the electrodes and bring them together with moderate pressure.

Close the circuit for 1/25 second (this may sound impossible, but it only requires a touch on the switch). The metal between the electrodes should not flow, because if it does so the weld has been too long. A little practice will soon produce good results.

For the benefit of readers interested in the subject of spot welding, a short article will be published in the next issue giving particulars of how the battery-operated spot welder described above can be adapted for use on A.C. mains.

A COURSE IN TELEVISION

(Continued from Page 59)

herent in the valve, slows down the rate of discharge and imposes a minimum limit on the duration of the flyback pulse.

The grid potential in a gas triode sets the voltage at which ionisation will occur. In practice, the simplest way to preset the grid potential is to return the grid to earth through a normal resistor R2 and provide for additional bleed current through a cathode resistor. Hence the inclusion of R2 and R3.

Thus, the point of ionisation can be set by the cathode potential, while the point of de-ionisation is determined by the valve. By suitable adjustment, the peak charge-discharge potentials can be set to any required small fraction of the supply voltage.

Furthermore, the rate of charge during the forward pulse is determined by the time constant of C and R. In all, there is room for much variation in the individual constants.

The objective is to so arrange the R/C time constant and the ionisation point in the tube that natural sawtooth frequency is a trifle lower than the required field frequency.

Under these conditions, a relatively small positive pulse on the control grid will cause the valve to ionise at the "synch." impulse and the spot will fly back to the start point ready for the next cycle of operation. This is illustrated in figure 5.

While the gas triode is simple and much favoured for oscilloscopes, it has serious limitations for television work. In the next issue we will examine the other types of circuit which are commonly employed.

SCIENCE CREATES NEW HOBBIES

(Continued from Page 9)

"caught on" after the last war were scientific in origin—greyhound racing depends upon the mechanical hare, the electrical totaliser and other mechanical devices; speedway racing was a combination of mechanical and personal skill.

In every sport there is the tendency to reduce the element of chance by science—from the preparation of golf-greens and design of balls with better ballistic characteristics to the refrigeration of tennis balls to ensure an even bounce or the scientific preparation of cricket pitches to prevent wear.

AIRCRAFT RACES

This tendency will continue and we shall probably see new scientific developments. Aeroplane racing presents difficulties in organisation, but may become important as a spectacle as well as a test of aircraft—the part played by racing in the development of aircraft is very great.

As everyone knows the Spitfire was a direct "descendant" of the craft that won the Schneider Trophy race, owing many improvements to experience gained in this way.

We may have "mechanised" races testing the skill of pilots which can be watched in a large hall by an audience. The pilots would "fly" on the Link-trainer system, where the cockpit remains stationary, but the course would be marked out exactly as if they had been flying.

Obviously the speeds attained by modern vehicles and aircraft, especially with jet-engines, is going to make racing difficult as a spectacle. Here we may see the development of sports based on "midget" engines, where the skill of the designer, the mechanic and the pilot or driver will combine to get results. Quite apart from the spectacle they provide, these forms of racing are as valuable in "developing the breed" as is horse racing.

Ultimately the test must come in action, and with a mechanical device —as with a racehorse—the final test is on the racecourse, however much theoretical considerations may suggest perfection. Aircraft races for miniature planes, wireless controlled, may become popular, skill being shown by the "pilots"

In all sports and pastimes our capacity to produce anything in quantities very cheaply should help. For instance, if our hobby is reading, we should have better books much more cheaply—and we shall certainly have micro-books so that it will be possible to have an extensive library in even a tiny modern flat.

The outlook for educational hobbies and pastimes in the postwar world is very bright—time, money and materials should be abundantly available, and it is up to us to take advantage of them.

WANTED—NEW HOBBIES

We shall continue to have people —like myself—whose work has been their hobby, but highly mechanised factories will offer less possibilities in this direction for the majority.

Their aim should be to find in their hobbies satisfaction for the creative instinct, whether it is in scientific breeding of improved poultry or new flowers, in inventing electronic devices which will have the additional advantage of making much household work "automatic" or labor saving, or in becoming experts, either as participants or spectators, in the new sports.

ABOUT POLARISED LIGHT

(Continued from Page 19)

In shipbuilding, the same method as been used to correctly design the essel for the purpose for which it is be used.

In the medical world, polarised light now being used to examine the surce of the skin. In this way, the nwanted glare from the skin surface blocked out and deeper defects are ore readily seen.

Surgeons are using the same method reduce the glare from wet tissue.

An ingenious arrangement for winws for flats has been developed by me spoilsport.

When the flats are arranged on each de of a central courtyard, the idea to have the windows on one side olarising vertically and those on the her side polarising horizontally. In is way each flat will gain the maxium light, but the dwellers therein ill not be able to look into the winws opposite.

When quinine became scarce during e war, Mr. Land sought for some ternative method of making a polarng plastic sheet. He finally developed a "molecular" sheet made from coke, lime, water and iodine in which the iodine crystals in combination with the molecules of polyvinyl alcohol are stretched until they form parallel "pickets."

This new type of polariser is now being used in experiments to produce anti-glare windscreens and headlights for motor cars.

At the present time, the problem has not been entirely solved.

The idea is to avoid the necessity of the vehicle driver wearing polarising spectacles.

It has been found that the diminution of light caused by the filtering out of most of the light vibrations creates a problem of its own by the fact that higher wattage headlights must be used, with a consequent increase in the size of the electrical power plant of the car.

No one can doubt that the future holds the key to the solution of this problem, which every day is becoming more urgent as the toll of the road grows alarmingly.

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MAKING YOUR OWN PRINTS

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the developing dish in a larger tray containing water at about 70 degrees.

After fixing, the prints must be washed in running water for at least an hour, in order to remove the hypo and prevent subsequent fading.

The main problem is to ensure that each print will have access to the running water, and that a number of prints do not collect in a mass. A good method is to suspend the prints in a deep container by means of plastic print clips, then feed water into the container at the top, and drain it from the bottom. Rate of flow should be sufficient to change the water in the container every five minutes.

Chemical methods of removing hypo may be of interest to those with restricted water supplies. Several products for this purpose have been marketed from time to time, but while most of them do remove the hypo, they frequently leave other chemicals which are just as undesirable.

The best appears to be the Kodak formula HE-1, the chemicals in which evaporate rapidly.

KODAK HYPO ELIMINATOR HE-1

Water	20oz.
Hydrogen peroxide (3 pc solution)	5oz
Ammonia (3 pc solution)	4oz.
Water, to make	40oz.

This quantity will process about 13 8 x 10 prints or their equivalent, so that most amateurs will be able to use much smaller quantities.

Prepare the solution immediately before use, and keep in an open container. Do not store in a stoppered bottle, or the gas may break the bottle.

Kodak recommend that prints be washed in the usual way for 30 minutes, and then immersed in the HE-1 for about six minutes. Finally, wash in water for 10 minutes. If the temperature is much below 68 degrees, these times should be increased.

Even if the above recommendations of water washing cannot be followed, the use of the eliminator will probably result in a greater freedom from hypo than is often possible by any other means

Three-Band-Three Receiver

(Continued from Page 55)

it will also serve to hold the shaft in place.

The pressure of the grommet against the metal disc should be carefully adjusted so that the drive is quite positive, but, at the same time it should not be so tight as to cause backlash. The job of adjusting the dial is made much easier if you have previously taken care to mount the dial plate perfectly true.

The dial card, which we manufactured with the aid of some indian ink and a ruling pen, measures 8in by 4½in. Use a piece of glossy card so that you can put in the calibrations roughly in pencil first and should they prove slightly inaccurate they can be rubbed out before the final ink calibrations are made.

NEAT WIRING

The wiring diagram will be of some help to you in interpreting the circuit, but it should not be taken too literally. For instance, it is often necessary to make junctions in the middle of connecting wires on the diagram to prevent it from appearing confused, but, actually, the junction would be made at a coil terminal or valve socket in practice.

The article on building radio set which was published in last month's issue will be of considerable help to your previous set building experience is limited.

This little set will certainly give you many hours of enjoyment and if you are thinking of studying for your amateur licence will be a great help both for obtaining Morse practice and getting to know other amateurs. With a good aerial and careful adjustment you will be amazed how strong overseas stations can be heard

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